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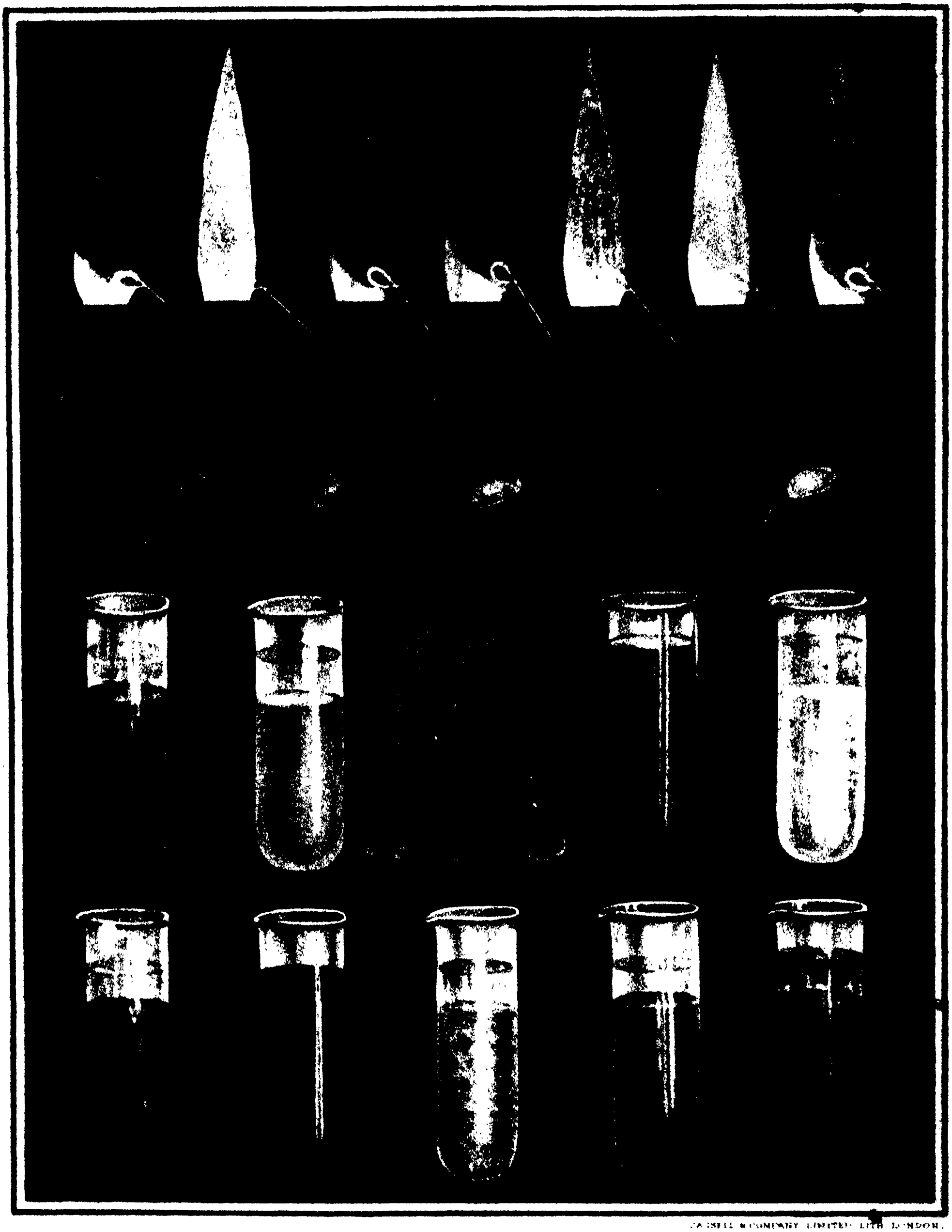

CASSELL & COMPANY LIMITED LITH LONDON.

COLOURED REACTIONS CHARACTERISTIC OF CERTAIN METALS, Etc.

Flame Colorations.—1. Copper. 2. Barium. 3. Strontium. 4. Calcium. 5. Potassium. 6. Sodium. 7. Boracic Acid.
Borax Beads × 3.—8. Cobalt. 9. Iron. 10. Copper. 11. Manganese. 12. Nickel.
Precipitates.—13. Iodide of Mercury. 14. Iodide of Lead. 16. Arsenic Sulphide. 17. Prussian Blue. 19. Manganese Sulphide. 20. Antimony Sulphide. 21. Ferrous Hydrate Oxidising to Ferric Hydrate on Surface.
Colours.—15. Copper Salt with excess of Ammonia. 18. Ferric Salt and Potassium Sulphocyanide. 22. Green Mass obtained by Fusing a Manganese Salt and Nitre on Platinum Foil.

THE

NEW POPULAR EDUCATOR

A Complete Encyclopædia

OF

ELEMENTARY AND ADVANCED EDUCATION.

VOL. VI.

CASSELL & COMPANY, LIMITED

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1891.

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N.B.—The answers to the exercises in each series of lessons will be found at the end of the lesson following that in which the exercises are set.

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CASSELL'S
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CHEMISTRY.—XVI.

[*Continued from Vol. V., p. 325.*]

ANALYSIS AND FORMULÆ OF ORGANIC BODIES—THEIR CLASSIFICATION—CYANOGEN—PRUSSIC ACID—UREA—THE HYDROCARBONS—"PARAFFIN"—CHLOROFORM—FORMIC ACID.

IF the substance contains nitrogen, it may be burnt as already described with certain additional precautions, and the nitrogen gas which is evolved collected over mercury and measured, or the substance may be heated with soda-lime, when, in most cases, all the nitrogen is evolved as ammonia, which is collected and estimated.

In order to arrive at the formula of a substance from its percentage composition, (1) the numbers are divided by the atomic weights of the respective elements; (2) the quotients so obtained are divided by the smallest of the quotients; the resulting quotients indicate the number of atoms of the respective elements. Thus, to take the analysis of the hydrocarbon given above—

$$\begin{array}{l} 88{\cdot}2\ \mathrm{C} \\ \underline{11{\cdot}8\ \mathrm{H}} \\ 100{\cdot}0 \end{array}$$

We divide 88·2 by the atomic weight of carbon, 12—

$$\frac{88{\cdot}2}{12} = 7{\cdot}35, \text{ and } \frac{11{\cdot}8}{1} = 11{\cdot}8\,;$$

these are divided by the smallest quotient, 7·35—

$$\frac{7{\cdot}35}{7{\cdot}35} = 1, \quad \frac{11{\cdot}8}{7{\cdot}35} = 1{\cdot}6.$$

These numbers show that the substance contains 1 atom of carbon to $1\frac{6}{10}$ths of an atom of hydrogen, but as we cannot have fractions of an atom, we multiply 1 and 1·6 by 5 to get rid of fractions, and thus get the formula C_5H_8.

It is obvious that a substance having the formula $C_{10}H_{16}$, $C_{15}H_{24}$, or $C_{20}H_{32}$ would have yielded exactly the same numbers on analysis, so that analysis alone cannot decide which of these formulæ is the true one; such a formula as C_5H_8, which only expresses the simplest ratio in which the elements are combined, is called an *empirical formula*. In order to determine the true formula of the molecule, we must use other means; the simplest plan, which is also the one most generally employed, is to determine the specific gravity of the vapour of the substance, since we know (Vol. IV., p. 1) that $\frac{\text{molecular weight}}{2}$ = specific gravity, or, in other words, molecular weight is double the specific gravity of the vapour. Now the vapour density of the above hydrocarbon was found to be 68, its molecular weight is therefore 136, and its *molecular* formula $C_{10}H_{16}$.

CLASSIFICATION OF ORGANIC SUBSTANCES.

The great bulk of organic substances may be divided into the following classes:—

1. *Hydrocarbons.*—These are bodies containing but two elements, carbon and hydrogen; there are several groups, the most important are:—

(*a*) The Marsh Gas or Paraffin series.

(*b*) The Olefine ("*i*" pronounced as *ee*) series.

(*c*) The Acetylene series.

(*d*) The Benzene or Aromatic series, many of its members being derived from the balsams, gums, and other aromatic substances. Benzene, C_6H_6, is the simplest of these hydrocarbons.

2. *Alcohols.*—As already mentioned, these may be considered as the analogues of the hydrates or hydroxides of the metals; thus, we have KHO, potassium hydrate; $(C_2H_5)HO$, ethylic hydrate, ordinary alcohol.

3. *Ethers.*—These are the oxides of the radicles; $(C_2H_5)_2O$, ethylic oxide, or ordinary ether.

4. *Sulphur, Selenium, and Tellurium Alcohols, etc.*—These contain sulphur, etc., instead of oxygen, and may be regarded as hydrosulphides, etc.; thus, C_2H_5HS, ethylic hydrosulphide, sulphur alcohol, or mercaptan.

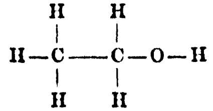
5. *Haloid Ethers and Ethereal Salts.*—These closely resemble, as regards their constitution, the

salts of the metals; thus the haloid ethers correspond to the chlorides, bromides, and iodides, and the ethereal salts to the sulphates, nitrates, acetates, etc. Thus C_2H_5Cl, ethylic chloride; $(C_2H_5)_2SO_4$, ethylic sulphate; and $C_2H_5\bar{A}$, ethylic acetate or acetic ether.

6. *Aldehydes.*—When a liquid containing alcohol, as wine or beer, is exposed to the air it turns sour, vinegar or acetic acid being formed, this is owing to the oxidation of the alcohol. If this oxidation be carefully conducted, an intermediate body is produced, termed aldehyde; it is formed from alcohol by the elimination of water and the absorption of oxygen—

$$\underbrace{C_2H_5HO}_{\text{Alcohol}} + O = H_2O + \underbrace{C_2H_4O}_{\text{Aldehyde}}.$$

For various reasons the constitution of alcohol is represented by the formula $\left\{\begin{matrix}CH_3\\CH_2HO\end{matrix}\right.$, or graphically



$$\begin{matrix} & & H & & H & & & & \\ & & | & & | & & & & \\ H & - & C & — & C & - & O & - & H \\ & & | & & | & & & & \\ & & H & & H & & & & \end{matrix}$$

Similarly, the constitution of aldehyde is represented $\left\{\begin{matrix}CH_3\\COH\end{matrix}\right.$. So that aldehydes have the characteristic group of elements, COH.

7. *Ketones* ("*o*" as in stone).—The formula of a ketone closely resembles that of an aldehyde, but instead of the group COH we have that of COR, where R represents an organic radicle; thus—

$$\left\{\begin{matrix}CH_3\\COH\end{matrix}\right. \text{Aldehyde.} \qquad \left\{\begin{matrix}CH_3\\CO(CH_3)\end{matrix}\right. \text{Ketone.}$$

8. *Acids.*—These form a very numerous class of bodies, some are monobasic, some dibasic, etc., as with the inorganic acids. They all contain the group COOH; thus—

$$\left\{\begin{matrix}CH_3\\COOH\end{matrix}\right. \text{Acetic acid.} \qquad \left\{\begin{matrix}COOH\\COOH\end{matrix}\right. \text{Oxalic acid.}$$

9. *Anhydrides* are simply the acids deprived of the elements of water—

$$\underbrace{2\left\{\begin{matrix}CH_3\\COOH\end{matrix}\right.}_{\text{Acetic acid}} = H_2O + \underbrace{\left(\begin{matrix}CH_3\\CO\end{matrix}\right)_2O}_{\text{Acetic anhydride}}.$$

10. *Acid Halides.*—These bear the same relation to the anhydrides as the haloid ethers do to the ethers. Thus $(C_2H_5)_2O$, ether; C_2H_5Cl, ethylic chloride; $(C_2H_3O)_2O$, acetic anhydride; C_2H_3OCl, acetylic chloride. It will be noticed that we have here an oxidised radicle, C_2H_3O, derived from ethyl, C_2H_5, by replacing two of hydrogen by one of oxygen. Such radicles are sometimes termed acid radicles; their names always end in "yl," as acetyl, etc.

11. *Organometallic Bodies.* — These are compounds of the radicles with various metallic elements. Thus we have sodium ethide, NaC_2H_5, zinc ethide, $Zn(C_2H_5)_2$.

12. *Amines.*—These resemble in many respects ammonia; they are strongly alkaline gases or liquids with powerful odours, they neutralise acids to form salts; they may be considered as ammonias in which one, two, or three atoms of hydrogen have been replaced by organic radicles, thus—NH_3, ammonia; $NH_2C_2H_5$, ethylamine; $N(C_2H_5)_3$, triethylamine, etc.

13. *Amides.*—These are mostly crystalline substances which play sometimes the part of a base, uniting with acids to form salts, while sometimes they combine with bases to form saline compounds, thus acting like acids. They may be regarded as ammonias in which the hydrogen has been replaced by an *acid* radicle, as $NH_2(C_2H_3O)$, acetamide; $N(C_2H_3O)_3$, triacetamide, etc.

In addition to the above there are many most important bodies which are at present relegated to what may be called the chemical lumber-room; we do not at present know their constitution, and so cannot place them in their proper class.

We will study first the negative radicle Cyanogen and its more common compounds.

Cyanogen, $(CN)_2$, is a colourless gas which burns with a pale purple flame, and has a pungent odour resembling that of bitter almond oil. It is prepared by heating mercury cyanide, $Hg(CN)_2 = Hg + (CN)_2$; the cyanogen is evolved as a gas, a small quantity of a brownish black substance, paracyanogen, being formed at the same time. The specific gravity of cyanogen gas is 26 ($H = 1$), its molecular weight is therefore $26 \times 2 = 52$, and its molecule, $(CN)_2$, $2C\ (= 24) + 2N\ (= 28), = 52$. Paracyanogen has the same percentage composition as cyanogen, *i.e.*, it contains carbon and nitrogen united atom to atom, but its molecular weight is much higher than $(CN)_2$, perhaps $(CN)_{10}$ or $(CN)_{20}$; such bodies which have the same percentage composition, but differ in molecular weight, are said to be "polymeric." Cyanogen can be condensed to a liquid by a pressure of about four atmospheres, and is extremely poisonous. The formula of cyanogen is often written Cy.

Hydrocyanic Acid, *Hydrogen Cyanide*, or *Prussic Acid* (HCN or HCy).—This dangerous substance is prepared on the large scale by distilling a mixture of potassium ferrocyanide, sulphuric acid, and water; the acid distils over with some water, and thus a strong solution of prussic acid is obtained. The pure acid is a colourless liquid, boiling at 26° Cent., which solidifies when cooled to $-18°$ Cent.; it is most fearfully poisonous, less than one drop being a fatal dose; it has a characteristic odour resembling bitter almond oil. A solution of about 2 parts of the acid in 100 of water is used in medicine; even in this exceedingly dilute state the dose administered is 2 to 5 drops. A solution of hydrocyanic acid gradually decomposes when kept, but it is found that the addition of a trace of hydrochloric or sulphuric acid materially tends to preserve the aqueous solution. Prussic acid is found in minute quantities in the kernels of peaches, plums, etc., in the leaves of the cherry laurel, in the crude oil of bitter almonds. Its action as a poison is extremely rapid, and as a rule death ensues before there is time to administer an antidote; the best treatment consists in pouring cold water on the head and neck, administering an emetic of a tablespoonful of mustard in warm water, the free use of stimulants, such as brandy, holding ammonia to the nostrils, etc.

Hydrocyanic acid forms a series of salts, the cyanides, which in some respects resemble the chlorides, bromides, and iodides.

Potassium Cyanide (KCN or KCy).—This salt is largely used in the arts, since its solution readily dissolves various silver salts, forming solutions suitable for electroplating. It is prepared on the large scale by fusing eight parts of potassium ferrocyanide with three parts of dry potassium carbonate until gas ceases to be evolved—

$$\underbrace{K_4FeC_6N_6}_{\text{Potassium ferrocyanide}} + K_2CO_3 = 5KCN + \underbrace{KCNO}_{\text{Potassium cyanate}} + Fe + CO_2.$$

Potassium cyanide is often formed in the blast furnace (*see* Iron, Vol. V., p. 129). It is a colourless crystalline substance very soluble in water; it has the odour of bitter almond oil, and is as poisonous as prussic acid, but its action is not quite so rapid.

If a solution of silver nitrate be added to a weak solution of potassium cyanide, a white precipitate of silver cyanide, AgCN, is thrown down, but the precipitate readily dissolves if more potassium cyanide be added.

Potassium Ferrocyanide or *Yellow Prussiate of Potash*, $K_4Fe(CN)_6$ or K_4FeCy_6.—This is prepared on the large scale by fusing in iron pots dry animal matter which contains nitrogen, such as horns, hoof-shavings, hair, etc., with potassium carbonate and iron-filings. The fused mass after cooling is treated with hot water and filtered; the solution on evaporation yields crystals of potassium ferrocyanide. This substance forms large pale yellow crystals which are particularly difficult to powder. It is soluble in water, and the solution is not poisonous; it is an exceedingly delicate test for iron salts, giving with ferric salts a dark blue precipitate, Prussian blue, Fe_7Cy_{18}.

Potassium Ferricyanide or *Red Prussiate of Potash* ($K_6Fe_2Cy_{12}$) is prepared by passing chlorine slowly through a solution of potassium ferrocyanide until it is reddish—

$$2K_4FeCy_6 + 2Cl = K_6Fe_2Cy_{12} + 2KCl.$$

The solution is then evaporated and allowed to stand, when the ferricyanide evaporates out in ruby-red crystals, which are easily soluble in water to a greenish solution. This solution when added to a ferrous salt (as $FeSO_4$) gives a dark blue precipitate known as Turnbull's blue, Fe_5Cy_{12}, but with ferric salts only a brown or greenish *coloration* is produced.

Ordinary Prussian blue forms a dark-blue mass with a coppery lustre, somewhat resembling indigo; when heated in the air it burns like tinder; it is much used as a paint; the colour is destroyed by alkalies (KHO, etc.).

Potassium Sulphocyanide or *Sulphocyanate* (KCNS).—Dry potassium ferrocyanide is fused with half its weight of sulphur; the fused mass is then extracted with water, and the iron in the solution precipitated by adding potassium carbonate; the filtrate is then evaporated, when colourless crystals of the sulphocyanide are obtained. This substance is very soluble in water, its solution has a bitter taste, it is not poisonous, it gives a deep blood-red colour with ferric salts.

Cyanic Acid (HCNO), the ammonium cyanate, is interesting since it offers a striking example of the ease with which the atoms often rearrange themselves in organic substances, and thus produce totally different compounds; if a solution of ammonium cyanate be evaporated, it is converted into quite another substance, urea—

$$\underbrace{NH_4CNO}_{\text{Ammonium cyanate}} = \underbrace{CO\left\{\begin{matrix}NH_2\\NH_2\end{matrix}\right.}_{\text{Urea}}.$$

Urea, $CO(NH_2)_2$, sometimes termed carbamide since it is carbon dioxide, CO_2, in which one atom of oxygen has been replaced by two amidogen, NH_2, groups. This substance occurs largely in the urine of mammals, and forms the chief substance by which the waste nitrogen leaves the body. When pure, urea is a transparent colourless crystalline substance, very soluble in water and alcohol; it has a cooling saline taste. When an impure solution is allowed to putrefy, the urea takes up water and is converted into ammonium carbonate—

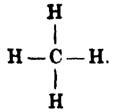
$$CO(NH_2)_2 + 2H_2O = (NH_4)_2CO_3.$$

In addition to cyanic acid, the molecular formula of which is believed to be HCNO, we have at least three other bodies which have exactly the same *percentage* composition, but *different* molecular weights, these are fulminic acid, $H_2C_2N_2O_2$, cyanuric acid, $H_3C_3N_3O_3$, and fulminuric acid, which has also the formula $H_3C_3N_3O_3$; when two bodies have in this way the same molecular weight they are said to be "isomeric."

The most interesting of these three substances is *Fulminic Acid*, $H_2C_2N_2O_2$; the acid itself has not been obtained, but its mercury salt is manufactured on the large scale for percussion caps, crackers, etc.

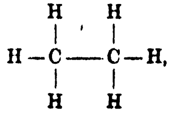
THE HYDROCARBONS.

1. *The Marsh Gas or Paraffin Series.*—The simplest member of this series is marsh gas or methane, CH_4; the carbon in this body is obviously a tetrad, and all its points of attachment or bonds are occupied by atoms of hydrogen, thus—



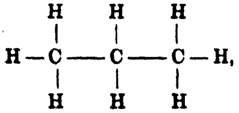
$$\begin{array}{ccccc} & & H & & \\ & & | & & \\ H & - & C & - & H. \\ & & | & & \\ & & H & & \end{array}$$

Now, if we replace one of the hydrogen atoms by methyl, CH_3, we have



$$\begin{array}{ccccccc} & & H & & H & & \\ & & | & & | & & \\ H & - & C & — & C & - & H, \\ & & | & & | & & \\ & & H & & H & & \end{array}$$

i.e., C_2H_6 or ethane, the second member of the series; if we repeat the process, we have



$$\begin{array}{ccccccccc} & & H & & H & & H & & \\ & & | & & | & & | & & \\ H & - & C & — & C & — & C & - & H, \\ & & | & & | & & | & & \\ & & H & & H & & H & & \end{array}$$

C_3H_8, or propane, the third member, etc. In this way we get a whole series of bodies up to $C_{24}H_{50}$. These bodies have many similar reactions, and they show a gradation of properties from the gas CH_4 through liquids to the solid paraffins which are used for making candles; such a series of bodies so closely resembling each other in constitution and reactions is termed an "*homologous series.*"

Many of the paraffins are found in nature in petroleum, naphtha, paraffin, or rock oil; they can also be obtained by the distillation of coal. When acted on by chlorine, bromine, etc., the hydrogen in the paraffins is partly and sometimes entirely replaced by the halogen element. The properties of methane have already been studied (*see* Vol. IV., p. 133). Ethane, propane, and butane are colourless gases closely resembling methane.

By far the most important source of the paraffins is the natural supply derived from the celebrated wells of America, Burmah, etc. Our younger readers can hardly realise the general state of domestic lighting some thirty years ago, before the introduction of the "paraffin lamp"; it is true that there was gas in the towns, and that the well-to-do had the moderator lamp burning the expensive colza oil, but the labourer had but the tallow candle and the rushlight. In 1847 a small spring of petroleum was discovered in a coal mine at Alfreton, in Derbyshire, by Lyon Playfair; this was worked by Messrs. Young and Meldrum, but became exhausted in two or three years. In 1850 Young turned his attention to a sort of coaly slate or slaty coal, known as Boghead coal or Torbane Hill mineral, and found on distilling this that he obtained a distillate containing much paraffin oil. In Pennsylvania petroleum had long been known to the Indians, and was collected and sold by the Seneca Indians as Seneca oil, but it was not till August, 1859, that the first borehole was opened at Titusville. This spring yielded over 800 gallons of oil per day; this quantity has been greatly exceeded by other wells, some of which have yielded over 100,000 gallons per day. These enormous supplies have considerably cheapened the price, and at the present day the excellent illuminating agent, "the paraffin lamp," is known in every cottage. The crude petroleum, or, as it is commonly called in this country, "paraffin," seems to be a mixture of a great variety of paraffins with a comparatively small quantity of hydrocarbons belonging to other series, olefines, etc.; the latter are destroyed by the action of strong sulphuric acid, etc.; the acid is then neutralised with soda, and the whole distilled. The portion which first passes over constitutes the so-called light petroleum, benzoline, petroleum spirit, naphtha, gazoline, ligroin, etc.; it is much used for dissolving grease, cleaning gloves, etc.; it boils from 40° to 120° Cent., giving off a heavy vapour which readily ignites. After this has been condensed, the ordinary paraffin oil, petroleum, or kerosene, used for burning in the common paraffin lamp, distils over between 150° to 200°. After this we have the soft, semi-solid vaseline, so much used for ointments, etc., and finally the hard solid paraffin used for candles. The name paraffin indicates that these bodies are but slightly acted upon by ordinary chemical reagents (*parum affinis*).

2. *The Olefine Series of Hydrocarbons.*—The lowest member of this series is olefiant gas, or ethylene, C_2H_4; it has already been described (*see* Vol. IV., p. 133); it forms the first member of another homologous series, ethylene, C_2H_4, propylene, C_3H_6, etc., to $C_{30}H_{60}$.

An account of the aromatic hydrocarbons, benzene, etc., will be given in a future lesson.

There are several other series of hydrocarbons, but their compounds are not so important as those of the series mentioned above.

We will now consider some of the bodies derived more or less directly from methane or marsh gas, the lowest member of the Paraffin series.

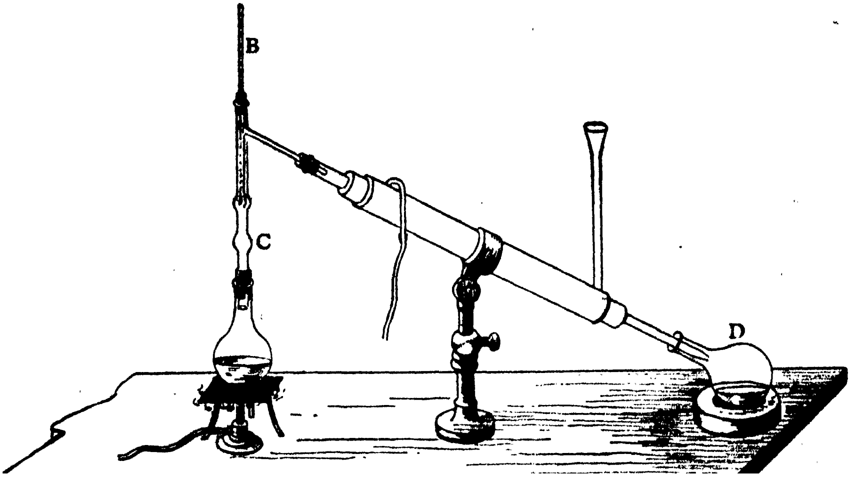


Fig. 49.

Methane by some is looked upon as the hydride of an organic radicle methyl, and its formula is then written CH_3H.

Methyl Hydrate or *Methyl Alcohol* (CH_3HO).—This is prepared from the aqueous liquid obtained by the dry distillation of wood. The crude wood spirit contains tarry matters and other impurities, from which it is freed by mixing with quicklime, redistilling, and then subjecting the purified liquid to a process known as fractional distillation. By this process a mixture of liquids of different boiling points can be separated more or less completely into its various constituents.

A simple form of apparatus for fractional distillation on the small scale is shown in Fig. 49. The liquid is placed in a flask, into the neck of which is fitted a long bulbed tube containing a thermometer, B, the bulb-tube has a T-tube connecting it with a Liebig's condenser (which consists essentially of a long glass tube, round which cold water circulates (*see* plate, Vol. III., p. 257); the liquid distilling over (distillate) is collected in a flask, D. We will suppose that we have a mixture of liquids boiling from 90° to 140° Cent. The liquid is heated until it boils, the vapour passes over into the bulbed tube, C, in which the least volatile portions condense and run back into the flask, while the more volatile pass into the condenser, and then into the receiver, D. The thermometer is carefully watched, and is found to rise slowly as the distillation proceeds; the distillate which comes over, say between 90° and 100°, is collected. D is then replaced by a fresh receiver, and the portion which comes over while the thermometer indicates 100° to 110° collected apart, and so various fractions are collected which have different boiling points. The process is then repeated with each of these fractions several times, and thus the various constituents can be separated in a fairly pure state. The various paraffins in the crude petroleum are separated in this way.

Pure methyl alcohol is a colourless liquid with a smell closely resembling that of ordinary alcohol, its specific gravity is 0·814, boils at 55° Cent., mixes readily with water, and burns with a pale blue flame; it is used in the manufacture of some anilin dyes.

Chloroform ($CHCl_3$) may be considered as marsh gas, CH_4, in which 3 atoms of hydrogen have been replaced by 3 of chlorine. This substance was discovered in 1831 by Liebig, and its power of producing insensibility by Sir J. Simpson in 1848. It is manufactured by stirring 10 parts of good bleaching powder ("chloride of lime") with 40 parts of water and 1 part of alcohol (specific gravity ·834). Much heat is evolved, and the chloroform is distilled over in a current of steam. It is a colourless mobile liquid, with a peculiar pleasant smell, and a burning taste; it boils at 61° Cent.; it is insoluble in water, but mixes with alcohol and ether. It dissolves phosphorus, iodine, fats, etc.; it is not inflammable.

Formic Acid ($HCOOH$) owes its name to the fact that it occurs in ants—in fact, a red ant, from a chemist's point of view, may be considered as a little bag of formic acid. It also occurs in the hairs of the stinging-nettle. It is usually prepared by heating ordinary oxalic acid with glycerine. Pure formic acid is a colourless liquid, with a penetrating odour; when placed on the skin it produces first a blister, and then a painful wound. It reduces gold, silver, and mercury salts to the metallic state; when warmed with strong sulphuric acid, formic acid splits up into carbon monoxide and water; it forms many salts, the formates, as $HCOOK$, potassium formate, etc.

HISTORIC SKETCHES, GENERAL.—XI.

[*Continued from Vol. V., p. 332.*]

THE RISE OF PRUSSIA.

THE kingdom of Prussia was a creature of very gradual growth. Like all other things that are great and worthy of respect, it had to be founded by wisdom and industry, and built up by suffering, patience, and perseverance. Not until the Thirty Years' War (*see* Historic Sketches, Vol. V., p. 136) had revealed to them their strength, and also given them the opportunity, did the Margraves of Brandenburg think of enlarging their borders till they should be worthy of the title of a kingdom. Hitherto the margraves had been content to be chief among the feudal dependants of the Emperor of Germany, and had found in the government of their own states, and in the assertion of their dignity, employment enough for their energies, and outlet enough for their ambition.

From a remote period that portion of Scythia which was known as Germany had been divided into a number of small states, differing as to title and importance according to their size, and according to the influence they were able to bring to bear upon head-quarters. Over all was the imperial ruler, elected by the chief of the lesser potentates, now from one house, now from another, not having hereditary dignity—at least until quite modern times—but chosen because he was considered to be the ablest man, the king, the man best able to serve the common weal.

The Electors were seven in number—the King of Bohemia, the Duke of Saxony, the Margrave of Brandenburg, the Count-Palatine of the Rhine, and the Prince-Bishops of Mayence, Treves, and Cologne, and these among themselves decided who should be chief of the feudal union of states which was known as Germany. According to the principles of the feudal system, each of the seven Electors—much more, therefore, those lesser dukes and counts who were not of sufficient importance to have a voice in the imperial election—was bound to render to the Emperor the allegiance of a vassal to a suzerain, an allegiance which differed from a general and absolute allegiance in this, that the vassal was in almost every department or relation of life free to act as he pleased within his own territory, but in all concerns which affected the union as a whole was bound to obey the will of the Emperor as dictator, to render him military service, and to contribute towards the common expenses of the Empire. Thus, when the Turks by their armaments threatened Western Europe, and commenced their attacks on the eastern provinces of Germany, it was incumbent on all the princes of the Germanic Empire to lend a hand, and to give money towards repelling the invaders; but when it came to be a question of domestic administration, say in Saxony, the duke of that province was not called upon by his allegiance to consult the Emperor in the matter, but possessed plenary power himself to deal with the matter without right of appeal.

There were very many of these petty states. When the soldier-chiefs who last occupied southern Scythia began to settle down, they took possession of such lands as their own followers happened to occupy, and holding them by the grace of God and the strength of their strong sword-arms, assumed the government of the territory, and succeeded in obtaining recognition from the most powerful of their class, who in his turn, and by virtue of the same title, assumed the title and position of emperor, the representative of the Western Emperor of the Roman Empire, the King of Italy, and the arbiter of European affairs.

The title of "graf," or "grave," was equivalent to count, and was the lowest grade of sovereign noble; then came duke (from the Latin *dux*, a leader) or herzog, signifying drawn out, elected, raised; and then came king, a title given to the holders of the larger principalities. Markgraf, or margrave, signified a count of the marches or borders, and was equivalent to the word marquis; a count-palatine signified originally a nobleman attached to the imperial household or palace, but was afterwards made to indicate the sovereign princes of those provinces which the Emperor had at one time or another conferred upon officers of his palace. From these dignitaries, who included prince-bishops among their number, were selected the seven Electors of the Empire, so that the title of elector came to be one of special honour, and was tacked on to the other titles of the possessor of it as distinctive and honourable. It was shared, as already stated, by counts, dukes, kings, and prince-bishops.

Certainly not least among the Electors was the Margrave of Brandenburg. Lord of the territory lying on the westernmost borders of the Empire, and including (since 1525) in his possessions the duchy of Prussia, he was exceedingly powerful, and could help or disoblige his neighbours to a very considerable extent. The neighbouring princes therefore courted his favour, and, where their interests and not their jealousies were concerned, depended upon him to support them against the power of the princes lying to the eastward. They rallied also round him as against foreign foes. Notwithstanding all these considerations, the Elector of Brandenburg remained loyal to the Imperial constitution till he could no longer do so and preserve his self-respect, or even his independence. The Thirty Years' War was, as has been shown, a war of religion, a war which went to the root of the question whether Protestantism should or should not exist in Germany in spite of the will of the Emperor, who was wholly opposed to it, and entirely devoted to the Roman Catholic faith. In this war the Elector of Brandenburg, who had embraced the doctrines of the Reformation, took part with the Protestant side, and gave in his hearty adhesion to Gustavus Adolphus and his successors in command. One of the results of the war was to show him how strong he was, and also to convince him, after the spirit that had been displayed in conducting the war, that the old lines of the German constitution were for ever obliterated, that is to say, that between him, those dependent on him, and the Emperor, the old principle of loyalty could no longer exist.

In 1701 the Elector Frederick, deeming himself strong enough to make good his act against all the world, with his own hands crowned himself king, and announced to the world that his name henceforth was not Elector of Brandenburg, but King of Prussia. The house of Habsburg sat on the imperial throne, and had procured that the dignity of emperor should be hereditary in the family. It could ill brook the assumption of kingly power by the most powerful vassal of the Empire in the west; but exhausted by the sustained efforts of thirty years of war, it was not in a position to take exception practically to the move, though it viewed the rise of Prussia with dislike, and waited for an opportunity of knocking it down again.

Frederick the First survived for twelve years his assumption of royal dignity, and during that time did his utmost to weld into a coherent mass the numerous parts which constituted his dominions. Upon his successor, Frederick William, devolved the task of preparing the new-born kingdom to guard against the storm which sooner or later, it was seen, must burst upon it. Not only was there the open hostility of Austria and her dependent states to be overcome so soon as those states should have sufficiently recovered to allow of their taking the field, but there were the jealousies of France and Russia to be met, and by some means, probably not without violence, to be allayed. For this work of preparation there was no fitter man than the second King of Prussia. A man with few ideas—some great ones were among them—he had the courage and the pertinacity to carry his ideas out to the fullest, and his aims were in the main for the advancement and benefit of Prussia as a European Power. He formed and organised the Prussian army on a model upon which his successor, Frederick the Great, hardly improved; he laid the foundation of Prussian finance on that basis of thrift which has been its chief and its most admirable characteristic ever since. The idea of military organisation throughout the country, so that every man of the population should be liable to soldier-service, was the king's; and so was the wisdom which placed the domestic laws upon a footing somewhat less unsatisfactory than that on which they had hitherto rested. Yet he was a prince hated quite as much as he was respected, particularly in his own family, where he acted as an insane tyrant, going the length on one occasion, when he had goaded his son, the crown prince, by repeated acts of oppression into the idea of deserting Prussia altogether, of condemning that son to death as a deserter, and of actually causing his son's friend and companion, Lieutenant Katte, to undergo the extreme penalty in the presence of the prince. Out of the school of this Tyrannus came Frederick the Great; from his brain issued, ready-made and armed at all points, the kingdom of Prussia, as Minerva is fabled to have done of old from the head of Jupiter. Into the inheritance left by such a man came Frederick the Great, in the year 1740, by which time the nations had had leisure to look around, and to take notice of the new peer which had sprung up among them.

France, weakened by the long and exhausting wars of Louis XIV., was quite unable, if she wished it, to crush the new Power; but it is probable she did not then see what has since been forced upon her notice, that Prussia might become a first-rate Power, capable of disputing the supremacy with her in southern Europe. Austria, however, saw, with quick instinctive eyes, that if she wished to be, as hitherto, first without question in Germany, she must at once, without losing an opportunity, strike a blow which should permanently injure Prussia, and reassert once and for ever her own superiority. She had recovered pretty well from her sufferings in the Thirty Years' War, and she saw that, in view of the compactness and the organisation which were so visible in the Prussian kingdom, she must even risk something rather than allow Prussia to make such headway. Suddenly she found that through the force of circumstances she was compelled to act on the defensive instead of the aggressive against her rival. The Emperor Charles of Germany died in 1740, and his daughter, Maria Theresa—for whose right to succeed Charles had been careful to obtain the recognition of the European Powers—found herself engaged in a contest with numerous foes who set up claims to the several portions of her empire. The Pragmatic Sanction, by which the assent of Europe had been given to Maria Theresa's claims, was disregarded by those most interested in doing so, England and some of the lesser German states being alone in their fidelity to their engagements. Frederick, who knew the national feeling of Austria, and the wishes of her statesmen towards him, determined to assume the offensive, and to pick up for Prussia what he could out of the ruins of the Empire. While the Elector of Bavaria claimed the Bohemian crown, which belonged essentially to the Austrian Habsburgs; while the King of Sardinia claimed the Duchy of Milan; and the imperial crown itself was claimed by no less than three hostile and powerful rivals, Frederick put in his claim to the province of Silesia, which he asserted to be his by virtue of some right which it is difficult now to follow. His claim being refused, he poured his fine troops into Silesia, and conquered the province, offering the Empress-Queen, however, to support her against all claimants to the Empire, if she would confirm him in the possession of Silesia. She refused, made an appeal to the nationalities under her for help, and in spite of French, Spanish, Prussian, and Bavarian armies, which swarmed about her territories, presented a bold front, and resolutely set herself to work to overcome her difficulties. By the aid of British money and British troops, Maria Theresa held her ground, though she was forced, as the price of buying cessation from Prussian attacks, to consent, after a brilliant victory gained by Frederick, to confirm Silesia to him by treaty. The other belligerents were compelled by force of arms to agree to a peace which for a while gave rest to Germany.

FREDERICK THE GREAT REVIEWING HIS TROOPS.

In 1756 broke out the Seven Years' War. The situation in Europe had changed. Maria Theresa was dead, and the interests of England required that she should ally herself with the King of

Prussia rather than with his foes; while France, glad of any support against England, with whom she was engaged in a chronic war, joined her forces with those of Austria. Hanover, in the British interest, sided with Prussia; Saxony sided with the Empire. The time seemed to have arrived for humbling Prussia, and for wresting Silesia again from her grasp. Frederick saw the storm coming, and being always ready, anticipated its arrival by himself invading Bohemia.

Now came the tug of war. By fine generalship Frederick made the whole of the Saxon army, encamped at Pirna, lay down its arms, and defeated at Lowositz the Imperial forces which were hastening to its relief. This was on October 1st, 1756. In the spring of the following year the Austrians and French were ready. The latter began to march on the southern frontier of Prussia; the former, under Prince Charles of Lothringen and Field-Marshal Broune, moved to attack the Prussians, and came up with them at Prague on the 6th of May. The Austrians lost 24,000 men, the Prussians 18,000, and the Prussians remained victors and masters of the field. Six weeks afterwards the battle of Kollin was lost by Frederick, with a loss of 14,000 men, after a contest of eight hours' duration; and to this succeeded a number of battles, now between Prussians and Austrians, now between Prussians and Austrians allied with Frenchmen, now between Prussians and Frenchmen combined with Russians. The odds were almost always against the Prussians, who supplied the want of numbers by the desperation which naturally inspires men fighting for actual existence, and who on several occasions achieved wonderful success, considering the proportion of enemies opposed to them. At Leuthen (5th of December, 1757), when the Prussians, under Frederick himself, were 32,000 against over 80,000 of Austrians, Bavarians, and Würtembergers, under the best generals of the day, the Prussians gained a decisive victory. Six thousand of the conquerors fell, but were revenged by the loss of 27,000 of the enemy, who also lost 116 guns and 51 flags; and of the strong Austrian army which had begun the campaign, only 37,000 reached Bohemia. Breslau, with a garrison of 18,000 men, surrendered, with all its stores and its military chest, to a force which did not number more than about 14,000. In other principal battles the Prussians were now victorious, now ruinously defeated, and more than once Berlin was occupied by hostile troops, and the capital of Prussia suffered the penalty of its king being at war with barbarians like the Russians. At Kunersdorf, on the 12th of August, 1759, Frederick experienced the greatest defeat he ever sustained—his army, nearly half the numbers of the Austrians and Russians, was beaten with the loss of nearly half its complement, of 170 guns, and 28 colours. It was a crushing defeat. But the spirit of Frederick was of the "no surrender" kind; and though, after this reverse, it seemed impossible for him to hold his own, and though his kingdom was exposed to all the horrors of invasion, he remained firm, gathered up his forces for another effort, and in August, 1760, overthrew the Austrians at Liegnitz with dreadful slaughter, and with great loss of cannon and military trophies. From this time to the end of the year 1762 the war went on with varying success, but the Prussians, aided by British subsidies to the extent during the seven years of £112,000,000, managed on the whole to win the mastery. On the 31st of December, 1762, France and Russia having withdrawn from the contest, the representatives of Prussia, Austria, and Saxony met at Hubertsberg, and arranged the basis of the Treaty of Paris, which restored peace on the basis of mutual restitution of conquests. Prussia gave up her hold on Saxony, and Austria consented to the integral union of Silesia with the new kingdom of Prussia. This kingdom entirely changed the whole character of its relations to the other European Powers. It came out of the war a recognised entity—a thing capable of being cultivated and of growing; it had no longer a doubtful or precarious status. Moulded by the second King of Prussia, perfected by the third, it grew in the interval between the Seven Years' War and the wars of Napoleon into a very considerable Power, second only in Germany to that wielded by the house of Austria. The Seven Weeks' War of 1866 showed what use Prussia had made of her opportunities since 1815, and proved that she was more than a match for her pristine master and later rival; while the Franco-German War of 1870-71, which ended in the disastrous defeat of France, brought Prussia to the height of its power, and directly resulted in the formation of the new German Empire, altogether apart from Austria, and with the King of Prussia at its head as German Emperor.

See :—C. A. Fyffe, *Modern Europe*; *Cassell's Universal History*.

GREEK.—VII.

[Continued from Vol. V., p. 336.]

THE THIRD DECLENSION (*continued*).

II. NOUNS WHOSE STEM ENDS IN *-σ* (*continued*).

(iii.) A few neuter nouns in *-ας* (*-αος*) are declined as follows, the final *σ* of the stem being lost, and the *α* contracted with the vowel of the case-suffix: *e.g.*, *τὸ γέρας*, *privilege.*

	Singular.	*Plural.*
N.A.V.	τὸ γέρας.	(γέρα-α) γέρα.
Gen.	(γέρα-ος) γέρως.	(γερά-ων) γερῶν.
Dat.	(γέρα-ι) γέραι.	γέρασι.

Dual.

N.A.V.	(γέρα-ε) γέρα.
G.D.	(γερά-οιν) γερῷν.

After γέρας decline τὸ γῆρας, *old age.* With these two may be connected some nouns whose stem ends in -τ—*e.g.*, τὸ κρέας, *flesh*; τὸ τέρας, *a prodigy*; and τὸ κέρας, *a horn* (in Attic prose only, τὸ κέρας), since after dropping the τ they may be contracted in the same manner. They have also the regular forms with τ. Thus, κέρας, κέρατος, and κέρως; κέρατι and κέρᾳ, etc. (indeed, κέρως and κέρᾳ are only found in Attic prose as military terms). Τέρας, however, has the two forms only in the plural, the contracted are the more common: thus, τέρᾱ, τερῶν.

III. NOUNS WHOSE STEM ENDS IN A VOWEL.

We pass on now to the third great division of the nouns which follow the third declension—namely, those whose stem ends in a vowel: *i.e.*, in -ι, -υ (-ευ, -αυ, -ου), -ο, or -ω.

We will take them in this order:—

(i.) *Nouns whose stem ends in -ῑ, -ῡ.* Of these nouns the vowel of the stem remains throughout. We take as examples: ὁ κῖς (gen. κι-ός), *the corn weevil*; ἡ σῦς (Latin *sus*), *a sow* (ῠ short in dissyllabic cases); ὁ ἰχθύς, *a fish* (ῡ in dissyllabic cases only).

Singular.

Nom.	ὁ κῖς.	ἡ σῦς.	ὁ ἰχθύς.
Gen.	κι-ός.	συ-ός.	ἰχθύ-ος.
Dat.	κι-ί.	συ-ί.	ἰχθύ-ῐ.
Acc.	κῖν.	σῦν.	ἰχθύν.
Voc.	κῖ.	σῦ.	ἰχθύ.

Plural.

N.V.	κῖ-ες.	σύ-ες.	ἰχθύ-ες.
Gen.	κι-ῶν.	σύ-ῶν.	ἰχθύ-ων.
Dat.	κι-σί.	συ-σί.	ἰχθύ-σι.
Acc.	κῖ-ας.	σύ-ας, σῦς.	(ἰχθύ-ας) ἰχθῦς.

Dual.

N.A.V.	κῖ-ε.	σύ-ε.	ἰχθύ-ε.
G.D.	κι-οῖν.	συ-οῖν.	ἰχθύ-οιν.

VOCABULARY.

Ἄγκιστρον, -ου, τό, a hook.
Ἀγρεύω, I catch.
Ἄγριος, -α, -ον, wild.
Ἄμπελος, -ου, ἡ, a vine.
Ἀνακύπτω, I emerge.
Βασιλεύω (gen.), I am king, I reign.
Βάτραχος, -ου, ὁ, a frog.
Βότρυς, -υος, ὁ, a bunch of grapes.
Ἴσος, -η, -ον, equal.
Μῦς, μυός, ὁ, a mouse (Latin *mus*).
Νέκυς, -υος, ὁ, a dead body, corpse.
Παγίς, -ίδος, ἡ, a trap.
Στάχυς, -υος, ὁ, an ear of corn.
Σύρος, -ου, ὁ, a Syrian.

EXERCISE 35.

Translate into English:—

1. Οἱ ἰχθύες ἐκ τοῦ ποτάμου ἀνακύπτουσιν. 2. Οἱ θηρευταὶ τὰς ἀγρίας σύας ἀγρεύουσιν. 3. Πάντες ἴσοι νέκυσι. 4. Ψυχῶν δὲ θεὸς βασιλεύει. 5. Ἡ ἄμπελος φέρει βότρυας. 6. Ἡ γῆ φέρει στάχυς καὶ βότρυας. 7. Τοῖς μυσὶ μάχη ποτὲ ἦν πρὸς τοὺς βατράχους. 8. Οἱ μύες παγίσιν ἀγρεύονται. 9. Οἱ Σῦροι σέβονται τοὺς ἰχθῦς ὡς θεούς. 10. Ἀγκίστροις ἀγρεύομεν τοὺς ἰχθῦς.

EXERCISE 36.

Translate into Greek:—

1. They catch fish with a hook. 2. Fish are caught with hooks. 3. The hunter lies in wait for wild boars. 4. The bunches of grapes and ears of corn are beautiful. 5. The vine bears grapes. 6. The frogs had (*to the frogs there was*) once a battle with (*against*) the mice. 7. We look on corpses. 8. The earth bears many vines.

(ii.) *Nouns whose stem ends in -ῐ, -ῠ.* The vowel of the stem remains only in the nominative, accusative, and vocative singular; in the other cases it passes into ε. In the genitive singular the masculines and feminines take -ως, and in the genitive plural -ων: as, ἡ πόλις, *a city*; ὁ πῆχυς, *an ell.* Neuters end in -εος in the genitive singular: as, τὸ σίναπι, *mustard*; τὸ ἄστυ, *a city.*

Singular.

Nom.	ἡ πόλις.	ὁ πῆχυς.	τὸ σίνᾱπι.	τὸ ἄστυ.
Gen.	πόλε-ως.	πήχε-ως.	σινάπε-ος.	ἄστε-ος.
Dat.	πόλει.	πήχει.	σινάπει.	ἄστει.
Acc.	πόλιν.	πῆχυν.	σίναπι.	ἄστυ.
Voc.	πόλι.	πῆχυ.	σίναπι.	ἄστυ.

Plural.

Nom.	πόλεις.	πήχεις.	σινάπη.	ἄστη.
Gen.	πόλε-ων.	πήχε-ων.	σινάπε-ων.	ἀστέ-ων.
Dat.	πόλε-σι.	πήχε-σι.	σινάπε-σι.	ἄστε-σι.
Acc.	πόλεις.	πήχεις.	σινάπη.	ἄστη.
Voc.	πόλεις.	πήχεις.	σινάπη.	ἄστη

Dual.

N.A.V.	πόλ(ε-ε)η.	πήχ(ε-ε)η.	σινάπε-ε.	ἄστ(ε-α)η.
G.D.	πολέ-οιν.	πηχέ-οιν.	σιναπέ-οιν.	ἀστέ-οιν.

Here belong the adjectives in -υς, -εια, -υ, which in declension depart from that of masculine and feminine substantives in this only, that the genitive of the masculine singular has the common form -εος (and not -εως) and that the neuter plural has -εα; thus, γλυκύς, *sweet.*

Singular.

Nom.	γλυκύς	γλυκεῖα	γλυκύ.
Gen.	γλυκέ-ος	γλυκείας	γλυκέ-ος.
Dat.	γλυκεῖ	γλυκείᾳ	γλυκεῖ.
Acc.	γλυκύν	γλυκεῖαν	γλυκύ.
Voc.	γλυκύ	γλυκεῖα	γλυκύ.

Plural.

Nom.	γλυκεῖς	γλυκεῖαι	γλυκέα.
Gen.	γλυκέων	γλυκειῶν	γλυκέων.
Dat.	γλυκέσι	γλυκείαις	γλυκέσι.
Acc.	γλυκεῖς	γλυκείας	γλυκέα.
Voc.	γλυκεῖς	γλυκεῖαι	γλυκέα.

Dual.

N.A.V.	γλυκέε	γλυκεῖα	γλυκέε.
G.D.	γλυκέοιν	γλυκείαιν	γλυκέοιν.

Here also belong the adjectives in -ῠς, -ῠ (gen. -εος), which are declined as γλυκύς, γλυκύ, only that the neuter plural is contracted into η, like ἄστη : as, ὁ, ἡ δίπηχυς, τὸ δίπηχυ, τὰ διπήχη, *two ells long.*

Some substantives in -ῐς, as well as the adjectives in -ις, -ι (as ἴδρις, ἴδρι, *skilful*), have the regular inflection, without any change of the radical vowel. For example, ὁ, ἡ πόρτις, *a calf* or *heifer ;* ὁ, ἡ οἶς, *a sheep ;* also (in the singular) ἡ ἔγχελυς, *an eel.*

Singular.

Nom.	ὁ, ἡ πόρτις.	ἡ ἔγχελυς.	ὁ, ἡ οἶς.
Gen.	πόρτι-ος.	ἐγχέλυ-ος.	οἰός.
Dat.	(πόρτι-ι) πόρτῑ.	ἐγχέλυ-ῐ.	οἰΐ.
Acc.	πόρτιν.	ἔγχελυν.	οἶν.
Voc.	πόρτι.	ἔγχελυ.	οἶς.

Plural.

Nom.	(πόρτι-ες) πόρτῑς.	ἐγχέλεις.	οἶες.
Gen.	πορτί-ων.	ἐγχέλε-ων.	οἰῶν.
Dat.	πόρτι-σι.	ἐγχέλε-σι.	οἰσί.
Acc.	(πόρτι-ας) πόρτῑς.	ἐγχέλεις.	(οἶας) οἶς.
Voc.	(πόρτι-ες) πόρτῑς.	ἐγχέλεις.	οἶες.

Dual.

N.A.V.	πόρτι-ε.	ἐγχέλε-ε.	οἶε.
G.D.	πορτί-οιν.	ἐγχελέ-οιν.	οἰοῖν.

VOCABULARY.

Ἀρχή, -ῆς, ἡ, a beginning, a principle, government; *pl.* magistrates.
Ἀσέλγεια, -ας, ἡ, wantonness.
Βέβαιος, -α, -ον, firm, sure.
Βροτός, -ή, -όν, mortal; οἱ Βροτοί, mortals.
Βρῶσις, -εως, ἡ, eating.
Διάφορος, -ον, different.
Δῶρον, -ου, το, a gift.
Ἔνδεια, -ας, ἡ, want.
Ἐπιθυμία, -ας, ἡ, desire.
Καρπός, -οῦ, ὁ, a fruit.
Κόσμος, -ου, ὁ, order, beauty, the world; ornament.
Κτῆμα, -ᾰτος, το, a possession.
Κτῆσις, -εως, ἡ, acquisition.
Μόνος, -η, -ον, alone, single.
Νόμος, -ου, ὁ, law.
Ὄνησις, -εως, ἡ, assistance.
Πόλεμος, -ου, ὁ, war.
Πόσις, -εως, ἡ, drinking.
Πρᾶξις, -εως, ἡ, doing, deed.
Πύργος, -ου, ὁ, a tower.
Σπάνις, -εως, ἡ, scarcity.
Στάσις, -εως, ἡ, insurrection, a rising.
Σύνεσις, -εως, ἡ, understanding.
Τεῖχος, -ους, το, a wall.
Ὕβρις, -εως, ἡ, pride, arrogance, insult.
Φύλαξ, -ᾰκος, ὁ, a watchman, guardian.
Φύσις, -εως, ἡ, nature.

EXERCISE 37.

Translate into English :—

1. Ἀσέλγεια τίκτει ὕβριν. 2. Ἐν πόσει καὶ βρώσει πολλοί εἰσιν ἑταῖροι, ἐν δὲ σπουδαίῳ πράγματι ὀλίγοι. 3. Ὁ πλουτὸς σπάνεως καὶ ἐνδείας τοὺς ἀνθρώπους λύει. 4. Ἕπου τῇ φύσει. 5. Αἱ ἀπὸ τοῦ σώματος ἐπιθυμίαι πολέμους καὶ στάσεις καὶ μάχας παρέχουσιν. 6. Ἐν ταῖς πόλεσιν αἱ ἀρχαὶ νόμων φύλακές εἰσιν. 7. Ἀπέχεσθε, ὦ πολῖται, στάσεων. 8. Ὀρέγεσθε, ὦ ἄνδρες, καλῶν πράξεων. 9. Διάφοροί εἰσιν αἱ τῶν βροτῶν φύσεις. 10. Ἐξ ὕβρεως πολλὰ κακὰ γίγνεται. 11. Κακοῦ ἀνδρὸς δῶρα ὄνησιν οὐκ ἔχει. 12. Δόξα καὶ πλουτὸς ἄνευ συνέσεως οὐκ ἀσφαλῆ κτήματά εἰσιν. 13. Οἱ τῶν σύκων καρποὶ γλυκεῖς εἰσιν. 14. Ἀρετῆς βέβαιαί εἰσιν αἱ κτήσεις μόναι. 15. Πολλὰ ἄστη τείχη ἔχει. 16. Οἱ τοῦ ἄστεος πύργοι βέβαιοί εἰσιν. 17. Οἱ πύργοι τῷ ἄστει κόσμος εἰσίν.

EXERCISE 38.

Translate into Greek :—

1. Riches free from (λύω) want. 2. We have friends in eating and drinking, but not in misfortune. 3. In the city the king is the guardian of the laws. 4. Obey, O young man, the magistrates. 5. O child, strive after honourable deeds. 6. The possession of virtue is alone sure. 7. The city has (*to the city are*) many towers. 8. Good laws bring honour to the city. 9. Follow nature. 10. The soldiers fight for the deliverance (σωτηρία) of the city. 11. O citizen, avoid insurrection.

(iii.) *Nouns whose stem ends in* -ευ, -ου, -αυ. The υ remains at the end of the word and before consonants, but disappears in the middle between vowels. Nouns in -ευς have in the accusative singular -α [the final υ of the stem having been in such cases regarded and sounded more as a consonant (like our *v*) than as a vowel (like our *u*), and so the ν of the accusative was weakened to short α (*vide supra* lesson IV.)] and in the accusative plural -ας; in the genitive singular, what is called the Attic form in -ως, instead of -ος; and in the dative singular, as well as in the nominative plural, admit contraction, which, however, is commonly not found in the accusative plural. If a vowel precedes -ευς, the whole singular and plural is contracted (as in χοεύς). Nouns in -αῦς and -οῦς take the contraction only in the accusative plural.

The words about to be declined are: ὁ Βασιλεύς, *a king;* ὁ χοεύς, *a measure* of liquid (about a gallon); ὁ, ἡ βοῦς, *a bull* or *cow*, *an ox* (Latin *bos, bovis*); and ἡ γραῦς, *an old woman.*

Singular.

Nom.	βασιλεύς.	χοεύς.	βοῦς.	γραῦς.
Gen.	βασιλέ-ως.	χο(εω)ῶς.*	βο-ός.	γρα-ός.

* That is, χοέως is contracted into χοῶς, χοέα into χοᾶ, χοέων into χοῶν, and χοέας into χοᾶς.

Dat.	*βασιλεῖ.*	*χοεῖ.*	*βο-ί.*	*γρα-ί.*
Acc.	*βασιλέ-α.*	*χο(εα)ᾶ.*	*βοῦν.*	*γραῦν.*
Voc.	*βασιλεῦ.*	*χοεῦ.*	*βοῦ.*	*γραῦ.*

Plural.

N.V.	*βασιλ-εῖς* (*or -ῆς*).	*χοεῖς.*	*βό-ες.*	*γρᾶ-ες.*
Gen.	*βασιλέ-ων.*	*χο(εω)ῶν.*	*βο-ῶν.*	*γρα-ῶν.*
Dat.	*βασιλεῦσι.*	*χοεῦσι.*	*βουσί.*	*γραυσί.*
Acc.	*βασιλέ-ας.*	*χο(εα)ᾶς.*	(*βο-ας*) *βοῦς.*	(*γρᾶ-ας*) *γραῦς.*

Dual.

N.A.V.	*βασιλ(έ-ε)ῆ.*	*χοέ-ε.*	*βό-ε.*	*γρᾶ-ε.*
G.D.	*βασιλέ-οιν.*	*χοέ-οιν.*	*βό-οιν.*	*γρα-οῖν.*

VOCABULARY.

Ἄρχω (gen.), I govern.
Ἀτιμάζω, I honour not, dishonour, despise.
Ἀχαριστός, -όν, unthankful.
Ἀχιλλεύς, -έως, ὁ, the hero Achilles.
Βούλομαι, I wish, will.
Γονεύς, -έως, ὁ, a parent.
Εἰκάζω (dat.), I liken to, compare with.
Ἕκτωρ, -ορος, ὁ, Hector.
Ἐπιμέλεια, -ας, ἡ, attention to, care.
Θύω, I sacrifice.
Ἱερεύς, -έως, ὁ, a priest.
Κῦρος, -ου, ὁ, Cyrus.
Λῆρος, -ου, ὁ, idle talk, chatter.
Νομεύς, -έως, ὁ, a shepherd.
Νομή, -ῆς, ἡ, a pasture.
Ὀδυσσεύς, -έως, ὁ, Ulysses.
Ὅμηρος, -ου, ὁ, Homer.
Ὀφθαλμός, -οῦ, ὁ, an eye.
Πάτροκλος, -ου, ὁ, Patroclus.
Πολύλογος, -ον, talkative.
Τε (*enclitic*)—**καί**, and—also, both.
Τηλέμαχος, -ου, ὁ, Telemachus.
Φονεύω, I put to death, kill, murder.

EXERCISE 39.

Translate into English :—

1. *Οἱ βασιλεῖς ἐπιμέλειαν ἔχουσι τῶν πολιτῶν.* 2. *Ἡ ἀγέλη τῷ νομεῖ ἕπεται.* 3. *Ἕκτωρ ὑπ' Ἀχιλλέως φονεύεται.* 4. *Οἱ ἱερεῖς τυῖς θεοῖς βοῦς θύουσιν.* 5. *Κῦρος παῖς ἦν ἀγαθῶν γονέων.* 6. *Οἱ ἀχαριστοὶ τοὺς γονέας ἀτιμάζουσιν.* 7. *Πείθου, ὦ παῖ, τοῖς γονεῦσιν.* 8. *Τηλέμαχος ἦν Ὀδυσσέως υἱός.* 9. *Βούλου τοὺς γονέας πρὸ παντὸς ἐν τιμαῖς ἔχειν.* 10. *Οἱ τῶν γραῶν λῆροι τὰ ὦτα τείρουσιν.* 11. *Καλῶς ἄρχεις, ὦ Βασιλεῦ.* 12. *Αἱ γρᾶες πολύλογοί εἰσιν.* 13. *Οἱ νομεῖς τὴν βοῶν ἀγέλην εἰς νομὴν ἄγουσιν.* 14. *Ὅμηρος τοὺς Ἥρας ὀφθαλμοὺς τοῖς τῶν βοῶν εἰκάζει.* 15. *Πάτροκλος φίλος ἦν Αχιλλέως.* 16. *Κῦρον, τὸν τῶν Περσῶν βασιλέα, ἐπὶ τῇ τε ἀρετῇ καὶ τῇ σοφίᾳ θαυμάζομεν.*

EXERCISE 40.

Translate into Greek :—

1. The flocks follow the shepherd. 2. The king has care of (for) the citizen. 3. Ears are tired by the idle talk of the old woman. 4. An old woman is talkative. 5. The shepherd leads the herd of oxen to the city. 6. Oxen are sacrificed to the gods by [*ὑπὸ* with gen.] the priests. 7. Parents are loved by their children. 8. It is the business of a good shepherd to take (have) care of his herds.

(iv.) *Nouns whose stem ends in -ο or -ω.* These are quite regular, but are sometimes contracted in the dative singular and accusative singular and plural: *e.g.*, *ὁ, ἡ θώς*, *a jackal*, and *ὁ ἥρως*, *a hero.*

Singular.

N.V.	*ὁ, ἡ θώς.*	*ὁ ἥρως.*
Gen.	*θω-ός.*	*ἥρω-ος.*
Dat.	*θω-ί.*	*ἥρω-ι or ἥρῳ.*
Acc.	*θῶ-α.*	*ἥρω-α and ἥρω.*

Plural.

N.V.	*θῶ-ες.*	*ἥρω-ες.*
Gen.	*θώ-ῶν.*	*ἡρώ-ων.*
Dat.	*θω-σί.*	*ἥρω-σι.*
Acc.	*θῶ-ας.*	*ἥρω-ας and ἥρως.*

Dual.

N.A.V.	*θῶ-ε.*	*ἥρω-ε.*
G.D.	*θώ-οιν.*	*ἡρώ-οιν.*

Some feminines in *-ώ* contract *-όος*, *-όϊ*, *-όα* in the singular into *-οῦς*, *-οῖ*, and *-ῶ* or *-ώ*, and form the vocative singular in *-οῖ*. The dual and plural, when used, are formed according to the termination *-ος* of the second declension. Examples are: *ἡ αἰδώς*, *modesty*, *respect*, and *ἡ ἠχώ*, *echo.*

Singular.

Nom.	*ἡ αἰδώς.*	*ἡ ἠχώ.*
Gen.	(*αἰδό-ος*) *αἰδοῦς.*	(*ἠχό-ος*) *ἠχοῦς.*
Dat.	(*αἰδό-ϊ*) *αἰδοῖ.*	(*ἠχό-ϊ*) *ἠχοῖ.*
Acc.	(*αἰδό-α*) *αἰδῶ.*	(*ἠχό-α*) *ἠχώ.*
Voc.	(*αἰδό-ϊ*) *αἰδοῖ.*	(*ἠχό-ϊ*) *ἠχοῖ.*

Plural.

N.V.	*αἰδοί.*	*ἠχοί.*
Gen.	*αἰδῶν.*	*ἠχῶν.*
Dat.	*αἰδοῖς.*	*ἠχοῖς.*
Acc.	*αἰδούς.*	*ἠχούς.*

Dual.

N.A.V.	*αἰδώ.*	*ἠχώ.*
G.D.	*αἰδοῖν.*	*ἠχοῖν.*

VOCABULARY.

βλέπω, I see.
Γοργώ,* ἡ, the Gorgon.
Δμώς, ὁ, a slave.
Ἐρατώ, ἡ, Erato, one of the Muses.
Εὐεστώ, ἡ, good condition.
Ἱστοριογράφος, -ου, ὁ, an historian.
Κῆπος, -ου, ὁ, a garden.
Κλειώ, ἡ, the Muse Clio.
Λυπηρός, -ά, -όν, sad.
Λυρικός, -ή, -όν, lyric.
Λυσίας, -ου, ὁ, Lysias.
Μήτρως, ὁ, maternal uncle.
Πάτρως, ὁ, an uncle on the father's side.

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* Plural from stem γοργον.

Πειθώ, ἡ, power of persuasion.
Προσβλέπω, I look at.
Πρόσειμι, I am present, I am near, at, belong to.
Πρόσωπον, -ου, το, a face, countenance.
Σέβας, τό [only with the nom. and acc.], reverence.
Ψεύδω, I lie, deceive.

Exercise 41.

Translate into English:—

1. Ὅμηρος ᾄδει πολλοὺς ἥρωας (or ἥρως). 2. Τὴν τῶν ἡρώων ἀρετὴν θαυμάζομεν. 3. Οἱ δμῶες βίον λυπηρὸν ἄγουσιν. 4. Ὁ τοῦ πάτρωος κῆπος καλός ἐστιν. 5. Ὀρέγου, ὦ παῖ, τῆς αἰδοῦς. 6. Αἰδὼς ἀγαθοῖς ἀνδράσιν ἕπεται. 7. Λυσίαν ἐπὶ τῇ πειθοῖ καὶ χάριτι θαυμάζομεν. 8. Τῇ αἰδοῖ πρόσεστι τὸ σέβας. 9. Μὴ πρόσβλεπε τὸ Γοργοῦς πρόσωπον. 10. Ὦ Ἠχοῖ, ψεύδεις πολλάκις τοὺς ἀνθρώπους. 11. Πάντες ὀρέγονται εὐεστοῦς. 12. Πρέπει παιδὶ καὶ νεανίᾳ αἰδῶ ἔχειν. 13. Κλειὼ καὶ Ἐρατὼ Μοῦσαί εἰσιν.

Exercise 42.

Translate into Greek:—

1. Homer sings (of) the hero Achilles. 2. The hero Achilles is sung by Homer. 3. The bravery of the hero is wonderful. 4. We admire the bravery of heroes. 5. Slaves have (*to the slaves is*) a sad life. 6. The uncle has (*to the uncle is*) a fine garden. 7. All rejoice at their (the) good condition. 8. Admire, O youth, with [μετὰ and gen.] modesty the deeds of good men. 9. By (dat.) the echo we are often deceived.

EXCEPTIONAL NOUNS OF THE THIRD DECLENSION.

There are some nouns of the third declension which cannot be classified, and the differential points of these must therefore be given separately. *e.g.*—

(1) Ἀνήρ, ἀνδρός, *a man*; γάλα, γάλακτος, *milk*; γόνυ, γόνατος, *a knee*; δόρυ, δόρατος, *a spear*; οὖς, ὠτός, *an ear*; χείρ, χειρός, *a hand*, etc. (but gen. dual, χεροῖν, and dat. pl. χερσί).

(2) Γυνή, ἡ, *a married woman, a wife*; gen. γυναικ-ός, dat. γυναικ-ί, acc. γυναῖκ-α, voc. γύναι; pl. γυναῖκες, γυναικῶν, γυναιξί, γυναῖκας.

(3) Ζεύς, *Zeus* (Jupiter); gen. Διός, dat. Διί, acc. Δία, voc. Ζεῦ.

(4) Θρίξ, ἡ, *hair*; gen. τριχός, dat. τριχί, etc.; dat. pl. θριξί.

(5) Κλείς, ἡ, *a key*; gen. κλειδός, dat. κλειδί, acc. κλεῖν; pl. nom. and acc. κλεῖς (also κλεῖδες, κλεῖδας), dat. κλεισί.

(6) Κύων, ὁ, ἡ, *a dog*; voc. κύον, gen. κυν-ός, dat. κυν-ί, acc. κύν-α; pl. κύνες, κυνῶν, κυσί, κύνας.

(7) Μάρτυς, ὁ, *a witness* (our *martyr*); gen. μάρτυρος, dat. μάρτυρι, acc. μάρτυρα, voc. μάρτυς; dat. pl. μάρτυσι.

(8) Ναῦς (Latin *navis*), ἡ, *a ship*; gen. νεώς, dat. νηΐ, acc. ναῦν; dual nom. and acc. νῆε, gen. and dat. νεοῖν; pl. νῆες, νεῶν, ναυσί, ναῦς. Compare γραῦς and βασιλεύς.

(9) Ὕδωρ, τὸ, *water*; gen. ὕδατος, dat. ὕδατι, etc.

Vocabulary.

Ἀθηναῖος, -ου, ὁ, an Athenian.
Αἴακος, -ου, ὁ, Æăcus.
Αἴδης, -ου, ὁ, Hades, god of the lower world (Pluto).
Αἰθίοψ, -οπος, an Æthiopian.
Ἀπιστός, -ον, unfaithful, inadmissible.
Δέησις, -εως, ἡ, a request, entreaty.
Δέχομαι, I receive
Ἐκκλησία, -ας, ἡ, an assembly (the New Testament word for *church*).
Ἰθύνω, I make straight, I direct.
Ἱστός, -οῦ, ὁ, a loom *or* mast.
Κάστωρ, -ορος, Castor.
Κίστη, -ης, ἡ, a chest.
Κοιλαίνω, I hollow.
Κομίζω, I carry, bring.
Κτείς, κτενός, ὁ, a comb.
Κτενίζω, I comb.
Κυβερνήτης, -ου, ὁ, steersman.
Κύβος, -ου, ὁ (our *cube*), a die.
Μαρτυρία, -ας, ἡ, testimony.
Οἰκία, -ας, ἡ, a dwelling.
Οἶκος, -ου, ὁ, a house.
Πέτρα, -ας, ἡ, a rock (hence *Peter*).
Πολυδεύκης, -ου, ὁ, Polydeukes, Pollux.
Σταγών, -όνος, ἡ, a drop
Σώζω, I save, rescue.
Σώτηρ, -ηρος, ὁ, a saviour, deliverer.
Ὠφέλεια, -ας, ἡ, advantage, ability.

Exercise 43.

Translate into English:—

1. Αἱ γυναῖκες τῷ κόσμῳ χαίρουσιν. 2. Οἱ Ἕλληνες σέβονται Δία καὶ Ποσειδῶ καὶ Ἀπόλλω καὶ ἄλλους θεούς. 3. Ταῖς γυναιξὶν ἡ αἰδὼς πρέπει. 4. Οἱ κύνες τὸν οἶκον φυλάττουσιν. 5. Ὁ κυβερνήτης τὴν ναῦν ἰθύνει. 6. Αἱ σταγόνες τοῦ ὕδατος πέτραν κοιλαίνουσιν. 7. Τῆς γυναικός ἐστι τὸν οἶκον φυλάττειν. 8. Γυναικὸς ἐσθλῆς ἐστι σώζειν οἰκίαν. 9. Ἀεὶ εὖ πίπτουσι Διὸς κύβοι. 10. Οἱ κύνες τοῖς ἀνθρώποις ὠφέλειαν καὶ ἡδονὴν παρέχουσιν. 11. Αἱ τῶν μαρτύρων μαρτυρίαι πολλάκις ἀπιστοί εἰσιν. 12. Κόμιζε, ὦ παῖ, τὴν τῆς κίστης κλεῖν. 13. Ὦ Ζεῦ, δέχου τὴν τοῦ ἀτυχοῦς δέησιν. 14. Κάστωρ καὶ Πολυδεύκης τῶν νεῶν σώτηρες ἦσαν. 15. Γυναικὶ πάσῃ κόσμον ἡ σιγὴ φέρει. 16. Οἱ Αἰθίοπες τὴν τρίχα μέλαιναν ἔχουσιν. 17. Ὦ γύναι, σῶζε τὴν οἰκίαν. 18. Τῷ κτενὶ τὰς τρίχας κτενίζομεν. 19. Αἴακος τὰς Αἴδου κλεῖς φυλάττει.

Exercise 44.

Translate into Greek:—

1. Ornament becomes a woman. 2. It is the business of women to guard the house. 3. They bring the keys of the house. 4. The keys of the house are brought to the mother. 5. The Athenians had many ships. 6. Jupiter had many temples.

7. The fish emerge out of water. 8. The steersman guides the ship. 9. The ship is guided by the steersman. 10. You worship Jupiter and Apollo.

IRREGULAR ADJECTIVES.

There are also some irregular adjectives—such as, πολύς, πολλή, πολύ, *much*, pl. *many*; μέγας, μεγάλη, μέγα, *great*; πρᾶος, πραεῖα, πρᾶον, *soft*—which are declined as follows:—

Singular.

	ὁ	ἡ	τὸ	ὁ	ἡ	τὸ
N.	πολύς	πολλή	πολύ.	μέγας	μεγάλη	μέγα.
G.	πολλοῦ	πολλῆς	πολλοῦ.	μεγάλου	μεγάλης	μεγάλου.
D.	πολλῷ	πολλῇ	πολλῷ.	μεγάλῳ	μεγάλῃ	μεγάλῳ.
A.	πολύν	πολλήν	πολύ.	μέγαν	μεγάλην	μέγα.
V.	[πολύ	πολλή	πολύ.]	μεγάλε	μεγάλη	μέγα.

The plural is quite regular —

N.	πολλοί	πολλαί	πολλά.	μεγάλοι	μεγάλαι	μεγάλα.
		etc.			etc.	

Singular.

Nom.	ὁ πρᾶος	ἡ πραεῖα	τὸ πρᾶον.
Gen.	πράου	πραείας	πράου.
Dat.	πράῳ	πραείᾳ	πράῳ.
Acc.	πρᾶον	πραεῖαν	πρᾶον.
Voc.	πρᾶος, πρᾶε	πραεῖα	πρᾶυ.

Plural.

N.V.	πρᾶοι [πραεῖς]	πραεῖαι	πραέα.
Gen.	πραέων	πραειῶν	πραέων.
Dat.	πράοις or πραέσι	πραείαις	πράοις or πραέσι.
Acc.	πράους [πραεῖς]	πραείας	πραέα.

Dual.

N.A.V.	πράω	πραεία	πράω.
G.D.	πράοιν	πραείαιν	πράοιν.

VOCABULARY.

Αἴγυπτος, -ου, ἡ, Egypt.
Ἀλέξανδρος, -ου, ὁ, Alexander.
Ἄλγος, -ευς, τὸ, pain, grief.
Ἀφθονία, -ας, ἡ, freedom from envy (α, *not*), abundance.
Ἔθος, -ους, τὸ, custom; *pl.* manners, morals; hence our *ethics*.
Ἰλιας, -αδος, ἡ, the Iliad.
Κροῖσος, -ου, ὁ, Crœsus.
Μακεδών, -όνος, ὁ, a Macedonian.
Μέγα, *adv.* greatly, very.
Ὀλίγος, -η, -ον, small; *pl.* few.
Ὀφέλλω, I nourish, augment, aid.
Πάθος, -ους, τὸ, suffering.
Προσαγορεύω, I name, call.
Πρόσοδος, -ου, ἡ, approach, income.
Σῖτος, -ου, ὁ, wheat, corn (*pl.* τὰ σῖτα).
Φόβος, -ου, ὁ, fear; φόβον ἔχειν, to have fear—that is, to cause fear.

EXERCISE 45.

Translate into English:—

1. Πολὺν οἶνον πίνειν κακόν ἐστιν. 2. Οἱ βασιλεῖς μεγάλας προσόδους ἔχουσιν. 3. Ἐν Αἰγύπτῳ πολλὴ σίτου ἀφθονία. 4. Ἡ θάλαττα μεγάλη ἐστίν. 5. Κροίσῳ ἦν πολὺς πλοῦτος. 6. Πολλάκις ἐξ ὀλίγης ἡδονῆς μέγα γίγνεται ἄλγος. 7. Πραέσι λόγοις ἡδέως εἴκομεν. 8. Τὰ μεγάλα δῶρα τῆς τυχῆς ἔχει φόβον. 9. Πολλῶν ἀνθρώπων ἔθη ἐστὶ πραέα. 10. Πόνος ἀρετὴν μέγα ὀφέλλει. 11. Οἱ παῖδες τοὺς πράους πατέρας καὶ τὰς πραείας μητέρας στέργουσιν. 12. Ὁμιλίαν ἔχε τοῖς πραέσιν ἀνθρώποις. 13. Αἱ γυναῖκες πραεῖαί εἰσιν. 14. Ἀλέξανδρον, τὸν Μακεδόνων βασιλέα, μέγαν προσάγορευσι οἱ πολλοί.

EXERCISE 46.

Translate into Greek:—

1. Abstain from much wine. 2. Bad men delight in much wine. 3. Much wine injures men. 4. Kings have great incomes. 5. The income of the kingdom is great. 6. Egypt has much corn. 7. Many have much-wealth, but little understanding. 8. Strive after mild manners. 9. The manners of the women are mild. 10. (There) is beauty in (*to*) mild manners. 11. Alexander, the king of the Macedonians, is often called the Great.

KEY TO EXERCISES.

Ex. 27.—1. All men have not the same mind. 2. We masticate our food with our teeth. 3. Dolphins are man-loving (animals). 4. It is the part of a good man to bear all evils with courage. 5. Many districts of Lybia abound in ivory. 6. All people hate a loquacious man. 7. Once the giants had a fight with the gods. 8. We rejoice in the rays of the sun. 9. It is the office of the nostrils to smell.

Ex. 28.—1. Ἡμῖν εστιν ἐλέφας. 2. Ἐν χώραις τῆς Λιβύης ὁ ἐλέφας γίγνεται. 3. Αἱ τοῦ ἡλίου ἀκτῖνες τοὺς ποιμένας τέρπουσι. 4. Οἱ ἀδελφοί τε καὶ αἱ ἀδελφαὶ χαιρουσιν ἐν ταῖς ἀκτῖσι τοῦ ἡλιου. 5. Ἡ ἀδελφὴ ἐστι καλή. 6. Θαυμάζομεν τὸν καλὸν τὸν ἐλέφαντα. 7. Πολλοὶ ἐλέφαντές εἰσιν ἐν τῃ Λιβύῃ. 8. Ὀδόντων ἐστὶν ἔργον λεαίνειν τὸ βρῶμα. 9. Παντός ἐστι σέβειν τὸ θεῖον. 10. Τοῖς θεοῖς ποτε ἦν πόλεμος πρὸς τοὺς γίγαντας.

Ex. 29.—1. In difficult matters few companions are faithful. 2. The supplicants touch our knees. 3. Death is a separation of the soul and body. 4. Wealth furnishes men with various aids. 5. Do not yield to the words of wicked men. 6. Do not, my son, be a slave to the service of the body. 7. The Greeks pour cups of milk as libation-offerings to the nymphs. 8. Accustom yourself to, and exercise your body with, toil and sweat. 9. Chatterers vex (*or* weary) the ear with repetitions (of the same story). 10. Accustom your soul, my son, to good deeds. 11. Evil stories do not lay hold of our ears. 12. We listen with our ears. 13. Do not hate a friend for a small fault. 14. My son, taste the milk. 15. The soldiers bear lances.

Ex. 30.—1. Ὦ νεανίαι, ἐθίζετε τὰ σώματα σὺν πόνῳ καὶ ἱδρωτι. 2. Ὀρεγόμεθα τῶν ἀγαθῶν πραγμάτων. 3. Πολλοὶ τέρπονται χρύσῳ. 4. Ἐξ ἀγαθοῦ πράγματος γίγνεται κλέος. 5. Τοὺς καλοὺς μύθους τῶν σοφῶν θαυμάζομεν. 6. Τὰ τῶν ἀγαθῶν ἀνθρώπων ἀγαθὰ πράγματα θαυμάζεται. 7. Οἱ στρατιῶται μάχονται λόγχαις. 8. Οὐ διαμείβομαι τον πλουτὸν τῆς ἀρέτης, τοῖς ἄναξι. 9. Μὴ πείθεσθε τοῖς λόγοις τῶν φαύλων.

Ex. 31.—1. The tragedies of Sophocles are beautiful. 2. We admire Socrates because of his wisdom. 3. Socrates has many disciples. 4. India produces many reeds alongside of its river and marshy districts. 5. Always tell the truth, my son. 6. Anaxagoras, the sophist, was the teacher of Pericles. 7. O Hercules, bring safety to the unfortunate. 8. Epaminondas was of an unknown father. 9. Pity an unfortunate man. 10. Be eager, O young man, for truth. 11. The immoderate serve a base servitude.

Ex. 32.—1. Σωκράτει ἦν θαυμαστὴ σοφία. 2. Ἐλέαιρε τοὺς ἀτυχεῖς. 3. Ἐλεαίρομεν τοὺς ἀτυχεῖς. 4. Πολλοὶ νεανιαι ἦσαν μαθῆται Σωκράτους. 5. Σωκράτει ἦν πολλὴ σοφία. 6. Θαυμάζουσι τὴν σοφιαν Σωκράτους. 7. Οἱ ἀκρατεῖς δουλεύουσι τὴν αἰσχρὰν δουλείαν. 8. Θαυμαζομεν τὰς καλὰς τραγῳδίας Σοφοκλέους. 9. Οἱ ἀληθεῖς λόγοι πειθονται. 10. Ἐλεαίρω τον βιον τῶν ἀκρατῶν. 11. Μὴ ἔχετε τὴν ομιλίαν τοῖς ἀκρατέσι.

Ex. 33.—1. The earth blooms with lovely flowers. 2. Keep not free from heat and cold. 3. We judge the honourable, not by length of time, but by virtue. 4. Every height in the mortal race is not secure. 5. Do not speak falsehoods. 6. We keep from evil gains. 7. Wicked gains ever bring disgrace. 8. Brass is the mirror of beauty, and wine of the mind. 9. Men aim at glory. 10. Men rejoice in glory. 11. The brave aim at glorious deeds. 12. We admire the glorious deeds of men.

Ex. 34.—1. Ἀπέχεται πονηρῶν κέρδων. 2. Οἱ σπουδαῖοι ἀπέχονται τῶν πονηρῶν κέρδων. 3. Οἱ σπουδαῖοι ὀρέγονται τῶν καλῶν. 4. Μὴ ἀπεχου, ὦ νεανια, θάλπους καὶ ψύχους ἀλλὰ τῶν πονηρῶν. 5. Ζημια ἕπεται τῷ ψεύδει. 6. Θαυμάζομεν τοὺς Ἕλληνας τῶν κλέων ἕνεκα. 7. Φεύγομεν πονηρὰ κέρδη. 8. Οἱ στρατιῶται χαίρουσιν ἐν τοῖς κλέεσι.

SKETCHING FROM NATURE.—I.

MATERIALS—CHOICE OF SUBJECTS, ETC.

In our lessons in Drawing, to be found in the previous pages of the New Popular Educator, we have endeavoured to place before our pupils the general principles which belong to and are applicable to the practice of drawing from the *flat* (that is, from copies), and also those principles which guide us in drawing from the *object*. We now undertake a more direct application of the instruction therein given, for the purpose of introducing our pupils to that very interesting and delightful practice of drawing, usually termed "sketching from nature"; we mean by this, the taking up of a few simple materials and seeking our subjects out of doors. The phrase "sketching from nature" is a very convenient one, and is generally understood, therefore we will retain it, although we prefer the expression "*drawing* from nature," as it implies greater care and attention to details than the term *sketching* in its usual sense. A loose habit of drawing may be called sketching, and if this were all that is understood by it, the practice would be a dangerous one for a beginner; but as we have already given sufficient cautions upon this point in the lessons upon Drawing, we will only repeat one piece of advice and pass on—"*Learn to draw first; sketch afterwards.*" In the course of these lessons we shall find it necessary occasionally to refer back to the lessons in Drawing already given, as our object is to apply practically the principles which have been there stated. How many times has the question been asked, "Do you draw?" And what is the reply in the great majority of cases? "Yes, but only from copies; I have never attempted to do anything from nature, having always considered it so much more difficult." Now, there are those who maintain the reverse, namely, that drawing from nature is easier than copying pictures. Certainly the former is much more pleasant, and more satisfactory, as all must acknowledge; whether it is easier or more difficult depends upon the inclination of the mind, the practical experience, or, speaking more exactly, *the kind of experience* the pupil has been accustomed to. If the grammar of the art has been well learnt, the pupil will find that a very considerable amount of the knowledge he has acquired whilst drawing from *the flat* will be of the greatest service when drawing from nature.

We have frequently met with portrait painters who have had to make duplicates of their pictures, and who have said they would much rather paint them again from the sitter than copy them from the original picture; only those who have experienced it can fully understand how much more feeling and life can be imparted to the work when nature is the guide than when they have to depend upon the limited expression of a copy. So with landscape: we have frequently been more pleased with the "original sketch," taken upon the spot, than with the finished picture painted from it in the studio at home. Although the "original sketch" was not so highly finished as the picture, yet it had the stamp of nature and freshness upon it, which could best be caught from the scene itself, and which it is difficult to impart at second hand. As the eye of the student becomes more and more accustomed to Nature, and keener to detect and appreciate her beauties, he will discover much of which a common observer has but an imperfect perception; to the latter a landscape is the same to-day as it was yesterday, he can only see trees, buildings, and other objects abstractedly through one and the same medium; while the eye of the artist is continually discovering something fresh, perhaps principally caused by the successive changes of light, or from the positions of objects in relation to each other, and their contrasts in both colour and form. The tree before him in the morning may certainly be the same that he sees in the evening, but how very different is the effect, and what a multitude of details with all their beauties, which were imperceptible in the morning, are brought out by the change of light. We have no doubt that many of our pupils, when they have conquered their early difficulties, will discover with pleasure and surprise that drawing from nature has a charm about it which cannot be realised by copying only.

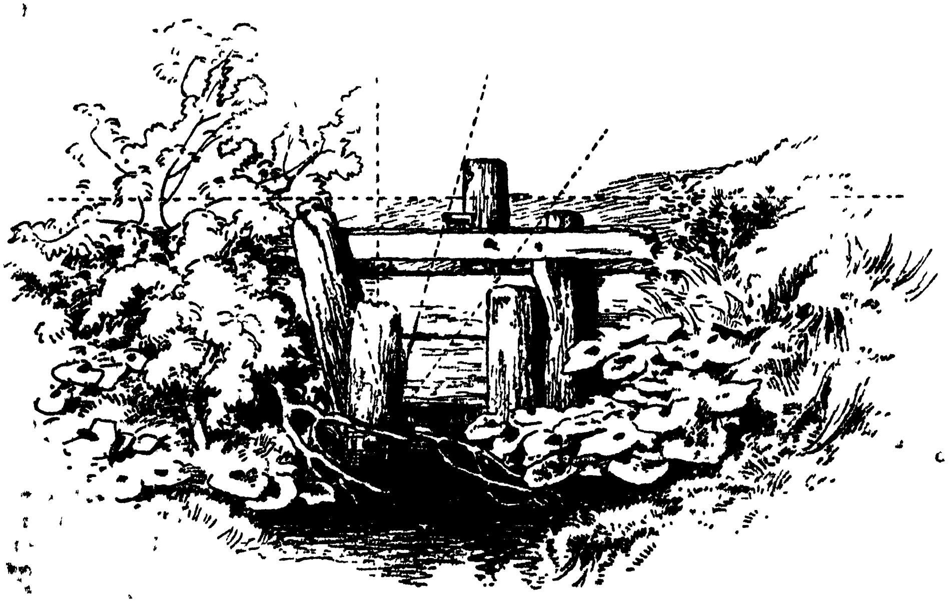

Fig. 1.

The necessary materials are simple:—A *block*, that is, a solid mass of paper composed of several layers bound together only at the edges, so that when a drawing is completed we have only to slip a penknife beneath it and the next paper, pass it round, remove the drawing, and underneath will be found another surface like the one already filled, ready for use. The kind of paper for pencil drawing ought not to be very rough, a slight grain will assist the pencil to mark freely, but on very rough paper it is impossible to give a very high finish to the work; rough papers are better adapted for colours. A few pencils, H, HB, and B, and a portable sketching stool, will be all that is requisite for our first essay. Being now prepared, let us suppose that we are on our way in search of a subject, and in the meantime we will make a few observations which especially apply to beginners. No one who has been accustomed to copy pictures only, can altogether comprehend what a very different thing it is to draw from nature until he has made the attempt, when he will discover there are several reasons for the difference. One is, that all the objects in the picture are reduced for him, probably to the exact size he wishes to make them; another is, the outline upon the paper has a more definite effect than the general form in nature, which admits of no actual *boundary line*, but presents only the *mass* discoverable from other objects by colour, and light and shade; another reason is, that objects in nature advance or recede from one another, whilst in a picture they are all arranged upon one plane or surface; and thus we are led to acknowledge the necessity of knowing something both of lineal and aërial perspective. It is true many depend upon the eye alone for the proportions of the retiring parts as they recede, and consequently are liable to make frequent and serious mistakes, which a little acquaintance with perspective would prevent; but we intend to take up this part of our subject again.

We will now pass on to another consideration with reference to the choice of subject for the first attempt of a beginner. We well know the feelings with which most beginners go out for the first time to draw from nature: their enthusiasm would persuade them to attempt great things; nothing short of some extensive prospect, hill and dale, woods, rivers, buildings—in short, a whole country side. Upon this point we wish to caution our pupils. It is one of the first and greatest mistakes which young painters make when they begin to draw from nature; nearly all, without exception, sit down to take some extensive view, without a question as to its composition, and without any

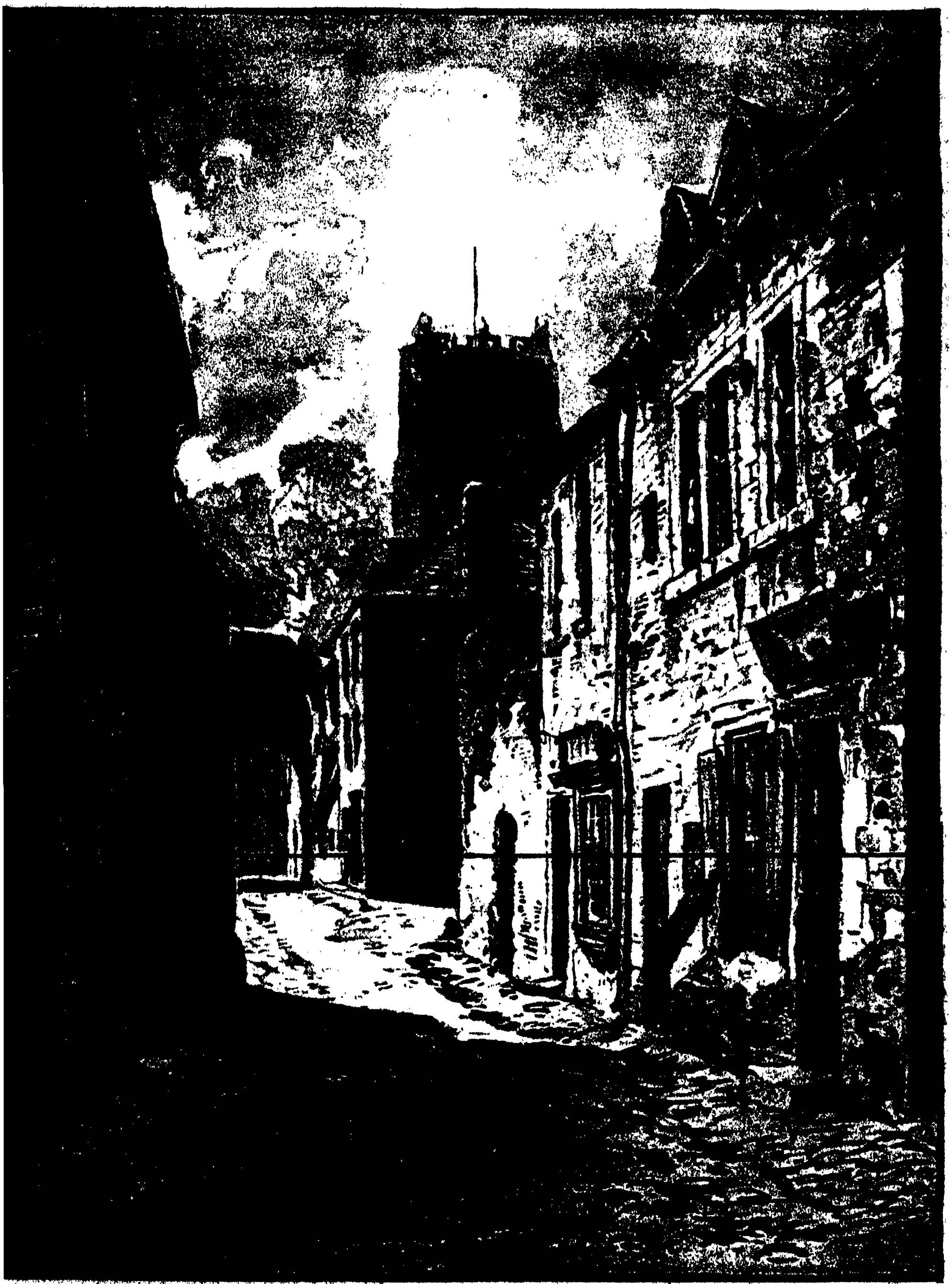

Fig. 2.

inquiry whether they will be able to go through with it. The principal reason they give for their choice is "the beauty of the scene." We heard of a case some years ago of a young student in the Royal Academy, who copied in the painting school an elaborate landscape by an old master; succeeding beyond his expectations, he felt a strong desire to paint a picture from nature, having now, as he thought, acquired sufficient power to justify the attempt. Accordingly he went to the top of Highgate Hill, and commenced a picture of the entire prospect looking northward; he worked hard for several days, but found he was alternately painting in and rubbing out; the constant changes of sunshine and shade, as they passed over the landscape, perfectly bewildered him, and the result was that he gave it up quite disheartened. He resolved, however, to show the little he had done to Constable (the painter of "The Corn-field" in the National Gallery), and ask his advice. Constable looked first at the picture and then at the youth, and in a quiet way, though with unmistakable meaning, said, "My young friend, go and draw a gate-post, and when you have done that draw two posts, and go on till you can manage a dozen; afterwards add a cottage, then a tree, and proceed in this way until you have power to do something more elaborate before you think of painting such a subject as this. You have made precisely the same mistake that I made when I was your age; you have begun at the wrong end."

The above excellent advice needs very little comment from us. It is exceedingly valuable, and forcibly suggests the folly of rushing headlong into a multitude of difficulties from which there is no escape, but at the cost of much discouragement. All must acknowledge that, whatever may be the extent of the subject they propose to draw, it is *essentially composed of several particular objects, each of which requires a separate and careful study.* Now the first question which everyone must ask himself should be, "Can I copy any one of these objects, independently of the rest?" If he cannot, let us assure him it would be useless to attempt the whole together. All who have reached any eminence in the art have found from experience the advantage of overcoming the difficulties connected with single objects first. Our pupils will clearly see from these remarks that the simpler the subject the better for a first trial, so that as their strength and confidence increase they will find themselves capable of enlarging their subjects, of entering more closely into their numerous details, and as they proceed a proportionate amount of increasing satisfaction will be gained, and the art itself will become more and more interesting.

Fig. 1 will give some idea of the class of subject for a first attempt, and the manner of treating it, which need not be much beyond a carefully arranged and cleanly drawn outline; the shadows might be slightly marked in by a few parallel lines under the projecting parts, down the shadowed sides of the posts, to define and bring forward the branch of a tree. In this simple arrangement of a few posts and weeds there are no important retiring lines, consequently there will be no necessity for vanishing points, a subject for our consideration further on. The distance of the station point, or the position of the draughtsman from an object of this class and extent, might be about a dozen or fourteen yards, because at that distance all contained within its outer limits will be considerably within an angle of 60°. (*See* lessons in Drawing, Fig. 25.)

Subjects of the class we have selected are very common: a stile, a bridge over a brook, and many more of the same kind, are to be found almost everywhere. We have just said that the drawing need not be more than a carefully arranged outline. If for some time the pupil will confine himself to outline, and use no more shadow than is necessary to assist in making the form clear and intelligible, it will be an advantage, because it is doing one thing at a time, and he is not overpowering himself with difficulties; besides, shading bad outlines is a waste of time, as shading cannot improve the drawing, nor can it be successfully practised without the *power* of correct drawing, as it is only an additional help to represent the form marked out by the outline. There are other important considerations to be attended to. The pupil must remember, when he is seated, that the few moments before he puts his pencil on the paper are very important. First, he must decide how much of the subject he intends to draw; that being determined, he must fix upon the centre of the subject to be arranged in the centre of his paper, and as in most cases the eye will be considerably below the centre, there will then be sufficient room for the sky above, and the foreground below the object. Probably a single trial will induce him to make this a general rule until experience has taught him to arrange this matter for himself according to his position and the nature of the subject he is drawing. The next piece of advice we would give him before he begins, is to fix his whole attention upon what he is about to draw; he must examine not only of what it is composed, but he must attentively observe how the several parts are arranged with regard to each other, and what are the rules and principles he has at command for his purpose. As he is about to draw it as it appears to him, without attempting any effect which does not strictly belong to it, he must take up one principle at a time. The first will be *form*—this refers, in the first instance, to the shape and character of the subject as a whole; then the position of the parts relative to each other; all important particulars must be carefully examined, his eye and his mind must become familiar with everything; this will strengthen his confidence, so that when he begins to draw, the acquaintance he has made with his subject will be of the greatest value. In practice, it is possible to determine the relative heights of the parts with one another by placing the pencil horizontally before the eye, having its edge on a level with any particular point, and by looking along the remaining portion of the pencil when thus placed, the pupil will be able to see at once which other portions are on the same level, which are above, and which below; he must notice where lines if produced would cut other lines already drawn, and also where one part is over or under another. We have drawn dotted lines in the illustration (Fig. 1) to show the various directions in which the pencil might be held between the eye and the object, and the result it gives in deciding how the parts are placed in connection with each other.

RETIRING LINES—POINT OF SIGHT, ETC.

If our pupils will carefully follow the advice we have just given them, and at first strictly confine their attention to very simple subjects, they will soon find themselves in a position to attempt with confidence something more advanced, which will include much that will make a demand upon their knowledge and experience in perspective. When we consider the infinite variety of the positions of lines, and the relations they bear to each other, so many difficulties arise, that we must naturally look about us for assistance altogether independent of mere *manual practice*, of which no amount of experience, however large it may be, can satisfactorily help us, and therefore we must have recourse to perspective. In our very first attempts *the one great difficulty* presents itself, viz., *how to draw the lines which retire*; here is the starting-point from which every rule proceeds, and this difficulty everyone will discover immediately he sits down to draw from nature. Objects parallel with our position, or with the picture plane, like the posts in Fig. 1, have no retiring lines—the lines which represent them are either horizontal or perpendicular; if horizontal, they are drawn across the picture, and those which are perpendicular in the object are drawn so. Therefore, with proper attention to the positions and proportions of these lines, exercises of this kind will be found very easy; but when we come to lines in other positions with regard to the picture plane, those *which retire*—that is, go away from us, like the lines of a railway when viewed from the top of a bridge—other considerations present themselves; lines of this class may retire either horizontally, or at an inclination. Those of our pupils who accompanied us through the course of Geometrical Perspective given in these pages will not have to be told that there are established rules to aid us in drawing these lines according to the position in which they may be placed; they will be satisfied upon this point, and they will have discovered that by working out these problems their practice in drawing them is rendered easier, and they will have found the *result* to be satisfactory. We have said before, there is no necessity, even if it were possible, to go through all the geometrical rules that can be applied to the subject when drawing from nature; but we do assert that *it is necessary to know them*, because, from having practised them upon subjects under given conditions, we can satisfactorily account for the position of every line we draw, let them be placed as they may. There are many who take great delight in drawing from nature who affirm that perspective is a science not at all necessary to them, although they allow that it is essentially so for architects. This is a mistake, which may be coupled with another into which they frequently fall, viz., that "it is too difficult to learn." They contend that "if the eye is properly educated, nothing more is required." This vague expression is one we have heard very often, and, of course, many who use it have no definite idea of what they mean by it. We ask such, what they wish us to understand by the "education of the eye?" The eye is not an instrument like the hand, which must have some considerable and practical experience in order to carry out the *intentions*; the eye has no *practical* duty to perform, it is simply the medium through which is conveyed to the mind the form, positions, and proportions of the objects to be represented; and since positions and proportions are not arbitrary, it follows that some kind of education is necessary to guide our judgment and practice in dealing with them: in other words, the mind must be prepared by some process to receive the full impression of everything connected with the object as it stands, or under any condition in which it may be placed, and to recognise details and peculiarities which, without a previous preparation, we should inevitably pass over, totally ignorant of their existence. We maintain that a little scientific education reveals facts which would otherwise be lost upon us. Consequently, we assert that the surest and shortest way to "educate the eye" is to educate the understanding, and one of the most effectual means for accomplishing this is the study of Geometrical Perspective. Experience in this branch of science strengthens our judgment with regard to the true positions of lines, and, more than that, it comes to our rescue when doubts arise, all of which can be satisfactorily disposed of by a knowledge of perspective. Without this knowledge, how very discouraging it is when we attempt to draw some large buildings, or a number of them together, to find that we have no principles to guide us, hoping the drawing may be right in the end, but labouring all the while in the greatest uncertainty, and dreading, at the same time, that should our work come under the inspection of an educated artist, he may detect many faults that might easily have been avoided if we had previously studied the *grammar* of the art.

We do not say this to discourage, quite the reverse: we wish to prove the necessity of the course of study we recommend; it is short and easy, and we may remark, for the encouragement of the timid, there is no need to carry it to the extent required by architects. As we proceed with our lessons, our pupils will easily find out for themselves how much is requisite, because, according to the class of subject we are drawing, occasions will present themselves which will make it necessary for us to refer to those rules which are applicable to the case, and most of which will be found in the previous pages of the NEW POPULAR EDUCATOR.

We will now direct the attention of our pupils to Fig. 2, which is *nothing more than an arrangement of straight lines in various directions*, each of which, whatever the direction may be, is subject to some especial rule for its treatment. The *view* we have selected (and we call it a view, because we wish to talk about it to our pupils as though we were actually out of doors in front of it) is as practical and simple as we could select: it is taken from a small street in one of our country towns. We have just said it is "an arrangement of straight lines in various directions." Now lines in the positions of those which compose our subject are so common, that there will scarcely be found an out-door scene which does not contain them; therefore the observations we are about to make will be found not only applicable to thousands of a similar description, but to numerous others of a much more ambitious character. If we were drawing the interior of a cathedral, we should have to repeat all that we have to say here, with as much more as might be rendered necessary by the different positions of other lines found in the cathedral.

Our pupils must now refer back, and read again the fixed principles relating to retiring lines and planes, as we are about to show how they may assist us to understand and draw the lines of the houses before us. The instructions we speak of referred more immediately to drawing from copies: we will now make them applicable to drawing from nature; and if they have been clearly understood in the former case, we have an easy task before us.

Let us suppose that we are seated opposite the end of the street, at about twenty or thirty yards from the nearest building, and that we have looked it over before we begin, and ascertained which lines retire from, and which are parallel with our position, and have particularly observed the general arrangement and the character of the details. We must first determine the line of sight, or, as it is sometimes called, the horizontal line, H L; by holding the pencil horizontally before the eye, and noting the places where it cuts the lines of the subject, it will be seen in our view to cross the door on the right hand at about one-third from the top. This is a very necessary step to take at the commencement, and must not be omitted, when we know that *all horizontal retiring lines have their vanishing points on the line of sight.* Our next consideration will be if we find that half of the subject upwards is above the eye (that is, the H L), and the other half below it, then the H L will be drawn across the middle of the paper; if the H L is placed as in the view before us, at about two-thirds from the top of the subject, then the line must be drawn at two-thirds of the distance from the top to the bottom of the paper.

Afterwards we must determine the position of the *point of sight: this is always opposite the eye on the line of sight.* In general practice we must so place ourselves, when we are looking down a street, that the parallel sides of the street shall be parallel to the imaginary line called the direction of sight, which goes from the eye to the P S—in other words, the sides of the street must retire at right angles with our position. In our view (Fig. 2) P S is the point of sight, and all the lines of the buildings on the right vanish at it—viz., the eaves of the roof, the tops and bottoms of the windows, the tops of the doors, the foundation line, and the courses of the bricks, all these lines being parallel with each other, and at right angles with our position. The lines of the building on the left vanish at V P, because they do not retire in the same direction, the two sides of the street in this case not being parallel.

FRENCH.—XXXI.

(Continued from Vol. V., p. 361.)

THE PRONOUN.—PLACE OF PERSONAL PRONOUNS USED AS SUBJECTS OF VERBS.

PERSONAL pronouns, used as subjects of verbs, are in French, as well as in English, placed before them in affirmative and negative sentences:—

J'inventai des couleurs, *j*'armai la calomnie, *J*'intéressai sa gloire; *il* trembla pour sa vie. RACINE.	*I invented colours, I armed calumny, I touched his glory; he trembled for his life.*

In affirmative or negative sentences commencing with *au moins*, *à peine*, *encore*, *peut-être*, *en vain*, *du moins*, *combien*, etc., the pronoun subject may be placed after the verb, although this construction is not imperative:—

Peut-être avez-*vous* raison. NOËL.	*Perhaps you are right.*
Peut-être vous entretiendrai-*je* aussi de l'astronomie. AIMÉ-MARTIN.	*Perhaps I will also converse with you on astronomy.*
Combien (l'homme) perd-*il* de vœux, *combien* fait-*il* de pas! LA FONTAINE.	*How many wishes he loses; how many steps he takes!*

In exclamations the pronoun subject is often placed after the verb in French, as well as in English:—

Puissé-*je* de mes yeux y voir tomber la foudre! CORNEILLE.	*May I with my own eyes see the thunderbolt crush it!*

In interrogative sentences the pronoun subject is placed immediately after the verb in the simple tenses, and between the auxiliary and the participle in the compound:—

Où suis-*je*? qu'ai-*je* fait? que dois-*je* faire encore?	*Where am I? what have I done? what have I yet to do?*

In interrogative sentences with verbs having only one syllable in the first person singular of the indicative present, and with some verbs having more than one syllable, the pronoun *je* is not placed after the verb. In such cases the sentence is introduced by *est-ce que*, and the leading verb is used affirmatively[*]:—

Est-ce que je cours?	*Do I run?* (literally, *Is it that I run?*)
Est-ce que je dors?	*Do I sleep?*
Est-ce que je comprends?	*Do I understand?*

The same construction is admissible with all the persons and tenses which may be used interrogatively.

REPETITION AND OMISSION OF THE PRONOUN SUBJECT.

It is proper to repeat the personal pronoun subjects *je*, *tu*, *il*, *elle*, *nous*, *vous*, *ils*, *elles* before every verb:—

Je lis, *j*'écris, *je* me promène.	*I read, write, and walk.*

The omission of the pronouns *je*, *tu*, *il*, *elle*, *nous*, *vous*, *ils*, *elles*, before the second or third verb of a sentence, is a matter of choice, but subject to the following restrictions:—

These pronouns must be repeated—

(1) When the first verb is in the negative and the second in the affirmative:—

Je ne plie *pas* et *je* romps.	*I do not bend and I break.*

(2) When the clauses are connected by conjunctions other than **et**, *and*; **ou**, *or*; **ni**, *nor*; **mais**, *but*:—

Nous détestons les méchants, parce que *nous* les craignons.	*We detest the wicked, because we fear them.*

In any other case the pronoun subject may or may not be repeated, as shown in the following examples:—

Repeated.	*Omitted.*
Je veux qu'on dise un jour aux peuples effrayes, *Il* fut des Juifs, *il* fut une insolente race. RACINE. *I wish that they may one day say to the frightened nations, there were Jews, there was an insolent race.*	*Il* s'arrache les cheveux, se roule sur le sable, reproche aux Dieux leur rigueur, appelle en vain à son secours la cruelle mort. FÉNELON. *He (Telemachus) tears his hair, rolls on the sand, reproaches the Gods with their rigour, and in vain calls cruel Death to his aid.*
Il s'écoute, *il* se plaît, *il* s'adonise, *il* s'aime. J. J. ROUSSEAU. *He listens to himself, he pleases himself, he adorns himself, he loves himself.* *Nous* avons dit, et *nous* allons prouver, qu'il n'y a pas de bonheur sans vertu. BEAUZÉE. *We have said, and we are going to prove, that there is no happiness without virtue.*	L'Éternel est son nom, le monde est son ouvrage, *Il* entend les soupirs de l'humble qu'on outrage, Juge tous les mortels avec d'égales lois, Et du haut de son trône interroge les rois. RACINE. *The Eternal is his name, the world is his work; he listens to the sighs of the humble oppressed, judges all mankind with equal laws, and questions the mighty from his lofty throne.*

PLACE OF PERSONAL PRONOUNS USED AS OBJECTS OF VERBS.

The personal pronoun used as direct object and the pronoun used as indirect object, with the preposition **à** (*to*) understood (dative of the Latin), are in French placed before the verb:—

Direct Object.	*Indirect Object.*
Je *vous* vois, *I see you.* Vous *les* voyez, *you see them.*	Je *vous* parle, *I speak to you.* Vous *leur* parlez, *you speak to them.*
Madame, enfin le ciel près de vous *me* rappelle. RACINE. *Madam, at last heaven recall's me near you.*	A ce prix je *leur* permets de vivre. RACINE. *On that condition I allow them to live.*
Pauvre science humaine! Un fil *t*'arrête, hélas, comme le moucheron Du bon Jean la Fontaine. AIMÉ-MARTIN. *Poor human science! a web stops thee, like the gnat of the good Jean la Fontaine.*	Il faut compter sur l'ingratitude des hommes, et ne laisser pas de *leur* faire du bien. FÉNELON. *We must expect ingratitude from men, but not cease, on that account, to do them good.*

1st Exception.—When the verb is in the second person singular, or in the first or second person plural of the imperative, used affirmatively, these pronouns must be placed after it:—

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[*] We may say, however, **suis-je?** *am I?* **ai-je?** *have I?* **fais-je?** *do I make?* **dois-je?** *should I? ought I?* **vois-je?** *do I see?* **vais-je?** *do I go?* **entends-je?** *do I hear?*

Voyez-*les*, *see them.*	Parlez-*leur*, *speak to them.*
Rends-*moi* chretienne et libre, à tout je me soumets. VOLTAIRE.	*Make me a Christian and free, I submit to everything.*
Dépouillons-*nous* aussi d'une vaine fierte. BOILEAU.	*Let us also divest ourselves of a vain pride.*
Allez, conduisez-*la* dans la chambre prochaine. RACINE.	*Go, conduct her into the next room.*

Remark.—But if the verb in these persons of the imperative is used negatively, the pronouns will be placed before the verb :—

Ne *les* voyez pas, *do not see them.*	Ne *leur* parlez pas, *do not speak to them.*
Si l'on vous propose de faire une mauvaise action, ne *la* faites pas.	*If they propose to you to commit a bad action, do it not.*
Dissipe tes douleurs, Et ne *me* trouble pas par ces indignes pleurs. BOILEAU.	*Dissipate thy grief, and trouble me not by these unworthy tears.*

2nd Exception.—With all reflexive verbs; with idiomatic verbal expressions consisting of a verb and a noun; when the verb is accompanied by *ne . . . que;* for the sake of emphasis in elevated style; also with the following verbs :—

Aller à, *to go to, towards.*
Accourir à, } *to run to, towards.*
Courir à, }
Être, *in the sense of* to belong.
Revenir, *to come back.*
Appeler, *to call.*
Venir à, *to come to.*
Boire à, *to drink to.*
Penser à, songer à, *to think of.*
Rappeler, *to call back.*
Attirer, *to attract* (but only when used in its literal sense):

those pronouns follow the verb :—

Je m'adresse *à* lui.	*I apply to him.*
Je vais *à* vous.	*I go to you.*
Vous courez *à* lui.	*You run to him.*
Elle vient *à* moi.	*She comes to me.*
Vous pensez *à* nous.	*You think of us.*
Ils songent *à* eux.	*They think of them.*
Je prends interet *à* lui.	*I am interested in him.*
Il ne pense qu'*à* elle.	*He thinks only of her.*
Je ne connais *que* vous ici.	*I know only you here.*
Cette maison est *à* nous.	*This house is ours.*
Je déclare *à* vous!	*I do declare to you.*

3rd Exception.—When the verb has several objects in the same case, whether they are all pronouns, or pronouns and nouns :—

Nous connaissons *lui* et son *frere.*	*We know him and his brother.*
Elle parle *à vous* et *à moi.*	*She speaks to you and to me.*
Votre neveu a ecrit *à mon père* et *à moi.*	*Your nephew wrote to my father and to me.*
Nous protegerons *toi, lui,* et *eux.*	*We will protect thee, him, and them.*

The pronoun used as indirect object and governed by any preposition except *à*, is always in French placed after the preposition, which, of course, follows the verb :—

Je parle *de lui* et *de vous.*	*I speak of him and of you.*
J'écris *pour lui* et *pour elle.*	*I write for him and for her.*
Qui rit d'autrui, Doit craindre qu'en revanche on rie aussi *de lui.* MOLIÈRE.	*He who laughs at others, must fear that in their turn they may also laugh at him.*

When two imperatives, used affirmatively, are joined together by the conjunction *et*, the pronoun object of the second may be placed before or after it :—

After the Verb.	*Before the Verb.*
Sortez et *laissez-moi* dormir. *Go out, and let me sleep.*	Sortez et *me* laissez dormir. *Go out, and let me sleep.*
Marche, et *suis-nous* du moins où l'honneur nous appelle. BOILEAU. *March and follow us, at least, where honour calls us.*	Laissez-*moi* cette chaine, ou *m*'arrachez le jour. LA HARPE. *Leave me this chain, or deprive me of life.*
Cessez, vous dis-je, et *laissez-moi,* Madame, executer les volontés du roi. RACINE. *Cease, I tell you, and suffer me, Madam, to execute the commands of the king.*	Vous attendez le roi; parlez et *lui* montrez, Contre le fils d'Hector tous les Grecs conjurés. RACINE. *You expect the king; speak and depict to him all the Greeks conspiring against the son of Hector.*

RESPECTIVE PLACE OF THE PRONOUNS WHEN TWO OCCUR WITH ONE VERB.

When two pronouns occur in the same clause—the one the direct object, the other the indirect object,—the indirect object, if not in the third person singular or plural, must precede the direct object :—

Il *me* le donnera.	*He will give it to me.*
Il *te* le prêtera.	*He will lend it to thee.*
Ils *nous* les montreront.	*They will show them to us.*
Vous *nous* le direz.	*You will say it to us.*
Quand je puis obliger, ma joie est assez grande; Pour n'attendre jamais que l'on *me* le commande. BOURSAULT.	*When I can oblige, my joy is great enough for me never to wait until they command me* (i.e., *they command it to me*).
Je *vous* le dis encore, vous n'aurez l'estime des hommes que par une solide vertu. MME. DE MAINTENON.	*I repeat it to you: you can obtain the esteem of men only by real virtue.*

When the pronoun indirect object is in the third person singular or plural, it must then be placed after the direct object :—

On *le lui* donnera.	*They will give it to him.*
Vous *le lui* preterez.	*You will lend it to him.*
Nous ne *le leur* prêterons pas.	*We will not lend it to them.*
Vous *le leur* écrirez	*You will write it to them.*
Le plus sûr appui de l'homme c'est Dieu, et vous voulez *le lui* ravir. BOISTE.	*The surest support of man is God, and you wish to deprive him of it.*

Remark.—The reflexive pronoun *se*, used as indirect object, is an exception to the above rule, as it takes precedence of the direct object :—

Si les hommes pensent mal les uns des autres, du moins ils ne *se le* disent pas. ANONYMOUS.	*If men think ill of each other, at least they do not say it to each other.*

The same rules and exception apply to the imperative used negatively :—

Ne *nous le* donnez pas.	*Do not give it to us.*
Ne *le leur* pretez pas.	*Do not lend it to them.*
Du sang de tant de rois c'est l'unique héritage; Ne *me l*'enviez pas, laissez-moi mon partage. VOLTAIRE.	*Of the blood of so many kings, it is my only inheritance; do not envy it (to me), leave me my portion.*

When the imperative used affirmatively has two pronouns as objects, the direct object precedes the indirect object :—

Envoyez-*le-moi.*	*Send it to me.*
Donnez-*le-nous.*	*Give it to us.*
Montrez-*le-moi,* ce mortel privilégie. BALLANCHE.	*Show him to me, that privileged mortal.*
Mets-*le-toi* dans l'esprit; qui fait mal, trouve mal. ANONYMOUS.	*Put this into thy mind: he who does evil, finds evil.*

Remark.—The rules given for the place of personal pronouns accompanying a verb in the imperative do not apply to its third persons, in regard to which the general rules given hold good:—

Qu'on *se le* dise.	*Let people say it to each other.*
Qu'il ne *me l'*envoie pas.	*Let him not send it to me.*
Qu'elle *le lui* donne.	*Let her give it to him.*

RULE ON THE PLACE OF PRONOUNS INDIRECT OBJECTS REFERRING TO PERSONS.

When a verb has for direct object a personal pronoun of the first or second person, and for indirect object, governed by *à*, a personal pronoun of the first, second, or third, *all referring to persons*, the personal pronoun direct object is placed as usual before the verb, but the preposition *à* is expressed and the pronoun indirect object is placed after it:—

Le roi m'envoie *à vous.*	*The king has sent me to you.*
Ils vous ont confié *à moi.*	*They have entrusted you to me.*
Il nous a recommandés *à eux.*	*He has recommended us to them.*
Il vous présentera *à elle.*	*He will introduce you to her.*

RULE ON THE RESPECTIVE USE OF LUI, ELLE, ETC., AND EN AND Y.

The personal pronouns *lui*, *elle*, *eux*, *elles*, used as indirect objects of verbs and preceded by a preposition, can only relate to persons, and not to things. The expressions *of* or *from it*, *of* or *from them*, when relating to things, should be rendered by *en*:—

J'*en* parle; j'*en* donne.	*I speak of it, of them; I give some.*
J'aime trop la valeur pour *en* être jaloux. LA HARPE.	*I prize valour too highly to be jealous of it.*
Celui qui est dans la prospérité doit craindre d'*en* abuser. FÉNELON.	*He who is in prosperity should fear to abuse it.*

The relative pronoun *y* is used in French in relation to things, sometimes to persons, as indirect object (dative), and is expressed in English by *at* or *to him*, *to her*, *to it*; *at* or *to them*, *thereto*, *therein*, etc.:—

J'*y* songerai, *I will think of it.*	Faites-*y*-attention, *Pay attention to it.*

C'est lorsque nous sommes éloignés de notre pays, que nous sentons surtout l'instinct qui nous *y* attache. CHATEAUBRIAND.	*It is when we are far from our country that we feel, above all, the instinct which attaches us to it.*
Tous nos jours vont à la mort, le dernier *y* arrive. MONTAIGNE.	*All our days travel towards death, the last one arrives at it (reaches it).*
Les choses de la terre ne valent pas qu'on s'*y* attache. NICOLE.	*The things of the earth are not worth our attachment to them.*

NOTE.—The pronoun *en* can only be used with verbs which require the preposition *de*; and the pronoun *y* with verbs which require the preposition *à*.

PLACE OF EN AND Y.

En and *y* follow the same general rules, as regards their position, which have been laid down above for the personal pronouns; but a few other points remain to be noted.

En and *y* are always placed after the other pronouns objects:—

Il *nous en* a parlé.	*He has spoken to us of it.*
Il *lui en* a dit quelque chose.	*He has told him something of it.*
Parlez-*lui-en.*	*Speak to him of it.*
Ne *nous en* parlez pas.	*Do not speak to us of it.*
Je *l'y* ai renvoyé.	*I have referred him to it.*
Renvoyez-*nous-y.*	*Refer or send us back to it.*
Ne *nous y* renvoyez pas.	*Do not refer us to it.*

When *en* and *y* are in the same clause, *en* is *always* placed after *y*:—

Envoyez-*y-en.*	*Send some there.*
N'*y en* envoyez pas.	*Do not send any there.*
Il *y en* a porté plusieurs.	*He has carried several of them there.*

REPETITION OF THE PRONOUNS USED AS OBJECTS.

These pronouns must, in French, be repeated before every verb:—

Ah! mon enfant, que je voudrais bien *vous* voir un peu, *vous* entendre, *vous* embrasser, *vous* voir passer. MME. DE SÉVIGNÉ.	*Ah! my child, how I should like to see you for a short time, to hear you, embrace you, see you pass.*
Je veux *le* voir, *le* prier, *le* presser, *l'*importuner, *le* fléchir. BESCHERELLE.	*I will see him, entreat him, press him, importune him, touch his heart.*

THE POSSESSIVE PRONOUN.

The possessive pronoun, in French, is always preceded by the article, which, as well as the pronoun itself, agrees in gender with the noun to which it refers; but it may differ from it in number:—

L'ambition ni la fumée ne touchent point un cœur comme *le mien.* J. J. ROUSSEAU.	*Neither ambition nor smoke have power on such a heart as mine.*
Au lieu de déplorer la mort des autres, je veux apprendre de vous à rendre *la mienne* sainte. BOSSUET.	*Instead of bewailing the death of others, I wish to learn from you how to render my own holy.*
Ma maison est haute, cependant *les leurs* sont encore plus hautes.	*My house is high, yet theirs are higher still.*

The pronouns *le nôtre*, *le vôtre*, etc., unlike the adjectives *notre*, *votre*, etc., always take the circumflex accent:—

La musique des anciens Grecs était très différente de *la nôtre.* VOLTAIRE.	*The music of the ancient Greeks was very different from ours.*

When the English possessive pronouns, *mine*, *thine*, etc., come after the verb *to be*, they are often rendered into French by the indirect pronouns *à moi*, *à toi*:—

Ce livre est *à moi.*	*That book is mine.*
Ces plumes sont-elles *à vous?*	*Are these pens yours?*

THE DEMONSTRATIVE PRONOUN.

The demonstrative pronouns can never be placed before nouns. They merely represent them:—

La meilleure leçon est *celle* des exemples. LA HARPE.	*The best lesson is that of examples.*
N'oublie jamais les bienfaits que tu as reçus; oublie promptement *ceux* que tu as accordés. BOISTE.	*Never forget the benefits which thou hast received; forget quickly those which thou hast conferred.*

The pronouns *celui*, *celle*, *ceux*, *celles*, as has been said, are often used absolutely, not only in the nominative, but also in the objective and in the oblique cases. In conjunction with the relative, they have the sense of *he who*, *him whom; that which*, etc.:—

Celui qui compte dix amis, n'en a pas un. MALESHERBES.	*He who reckons ten friends has not one.*
On ne saurait forcer *celui* qui ne veut pas.	*We cannot compel him who will not.*
L'harmonie la plus douce est la voix de *celle* qu'on aime. LA BRUYÈRE.	*The sweetest harmony is the voice of her whom we love.*

The French use *celui*, *celle; ceux*, *celles* indifferently for *this*, *that; these*, *those*. When they institute a contrast or a comparison, they add the adverbs * *ci* (*ici*) and *là* to the pronouns:—

Corneille nous assujettit à ses caractères et à ses idées; Racine se conforme aux nôtres. *Celui-là* peint les hommes comme ils devraient être, *celui-ci* les peint tels qu'ils sont. LA BRUYÈRE.	*Corneille subjects us to his characters and to his ideas; Racine conforms himself to ours. The former paints men as they should be, the latter paints them as they are.*

Celui-ci, *celle-ci*, *ceux-ci*, *celles-ci*, *celui-là*, etc., may be used absolutely in French in the sense of *this one*, *that one*, etc.:—

On la vit, toutes les semaines, essuyer les larmes de *celui-ci*, pourvoir aux besoins de *celui-là*. FLÉCHIER.	*Every week, she was seen wiping the tears of this one, providing for the wants of that one.*

Ceci and *cela* are always used absolutely, and have no plural. They serve to point out things only. They can, of course, never be placed before a noun:—

Tant que le jour est long, il gronde entre ses dents, Fais *ceci*, fais *cela*, va, viens, monte, descends. REGNARD.	*The livelong day he mutters between his teeth, do this, do that, go, come, go up, come down.*
Je suis un peu surpris de tout *ceci*. MASSILLON.	*I am a little surprised at all this.*
Vous n'avez pu désavouer *cela*. PASCAL.	*You have not been able to disavow that.*

REMARKS ON THE DEMONSTRATIVE PRONOUN CE.

Ce, when used as a demonstrative pronoun, is construed with the verb *être*, or with a verb followed by *être*, or with a relative pronoun:—

C'est un poids bien pesant qu'un grand nom à soutenir. MONTESQUIEU.	*A great name is a very heavy weight to sustain.*
Ce qui me plait *c'est* sa modestie. LÉVIZAC.	*That which pleases me is her modesty.*
Ce doit être lui.	*It must be he.*
Ce que vous dites est faux.	*What (that which) you say is untrue.*
Je sais *ce dont* il se plaint.	*I know that of which* (*of what*) *he complains.*

Ce is used for *he*, *she*, *they*, preceding any part of the verb *to be*, when that verb is followed by a noun, or an adjective used substantively and preceded by *the*, *a*, or *an*, or a possessive or demonstrative adjective, or any kind of pronoun.

Observe that the verb *être*, following the pronoun *ce*, is put in the plural when the noun, possessive or demonstrative pronoun following that verb is plural. The pronoun *ce*, however, remains unchanged:—

C'est un trompeur.	*He is a deceitful man.*
C'est la femme que je cherche.	*She is the woman whom I seek.*
C'étaient mes amis.	*They were my friends.*
Ce seraient paroles exquises, Si *c'était* un grand qui parlât. MOLIÈRE.	*They would be exquisite words if a great man were speaking them.*
N'*étaient-ce* pas les mêmes hommes? CHATEAUBRIAND.	*Were they not the same men?*
Ce sont les miens, ce ne *sont* pas les vôtres.	*They are mine, they are not yours.*
Ce sont celles que j'ai vues.	*They are those I have seen.*

This is, *that is*, *these are*, *those are*, may also be rendered by *c'est ici*, *ce sont ici*, or by *voici* and *voilà*:—

C'est ici la place.	*This is the place.*
Ce sont la mes enfants.	*Those are my children.*

Voici, *voilà*, are, however, to be preferred to *c'est ici*, etc.:—

Voici la place.	*This is the place.*
Voila mes enfants.	*Those are my children.*

Ce answers to the English pronoun *it*, when the latter stands as the impersonal subject of the verb *to be* (*i.e.*, without reference to an antecedent):—

Ce n'est que par les sens que l'âme peut s'instruire. FONTANES.	*It is only through the senses that the mind can receive instruction.*
Ce fut d'une retraite de pâtres et d'aventuriers, que sortirent les conquerants de l'univers ROLLIN.	*It was from a refuge for shepherds and adventurers, that emerged the conquerors of the world.*
*C'*est un défaut capital qu'il faut eviter dans quelque sujet que *ce* soit. VOLTAIRE.	*This is a fatal defect which should be avoided in whatever subject it may be.*

When the verb *être*, however, is used impersonally, and followed by an adjective, the pronoun *it* is not rendered by *ce*, but by the pronoun used with all impersonal verbs: viz., *il*:—

Il est necessaire d'étudier.	*It is necessary to study.*
Il est plus difficile pour les nations que pour les individus, de recouvrer l'estime de leurs voisins quand elles l'ont perdue. BOISTE	*It is more difficult for nations than for individuals to recover the esteem of their neighbours when they have lost it.*

THE RELATIVE PRONOUN.

The relative pronoun **que**, *whom*, *which*, *that*, can never be suppressed like the corresponding English pronouns *:—

Les louanges *que* nous donnons, se rapportent toujours par quelque chose à nous-mêmes. MASSILLON.	*The praises (which) we give have always in some way a relation to ourselves.*

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* The same adverbs produce the same difference in meaning with the demonstrative adjectives **ce, cet**, etc. They are not placed immediately after those adjectives, but after the nouns which they determine: **cet homme-ci,** *this man;* **cet homme-là,** *that man.*

* The conjunction *that* is often omitted in English; its equivalent, *que*, must always be expressed in French:—

Je crois *qu'*il est ici.	*I believe (that) he is here.*

The pronouns *quel*, *que*, *quoi*, *lequel*, represent the English pronouns *which* or *what* used interrogatively.

(1) *Quel* is used before a noun in a determinative sense :—

Quel livre lirons-nous?	*What* or *which book shall we read?*
Quel est donc votre mal? MOLIÈRE.	*What, then, is your ailment?*

(2) *Que* is used before a verb :—

Que dites-vous?	*What do you say?*

(3) *Quoi* is used as an exclamation, and with a preposition :—

Quoi! est-ce vous?	*What! is it you?*
De quoi parlez-vous?	*Of what are you speaking?*
Quoi de plus beau que la vertu?	*What is more beautiful than virtue?*

(4) *Lequel*, used interrogatively, means *which one* :—

Voici deux plumes ; *laquelle* voulez-vous?	*Here are two pens; which (which one) will you have?*

Qui is used without antecedent, affirmatively and interrogatively, as direct and as indirect object. It then means *whom*, *of whom*, *to whom*, *whose*, etc. :—

Qu'elle épouse *qui* elle voudra.	*Let her marry whom she likes.*
Nous savons *de qui* elle est fille.	*We know whose daughter she is.*
Qui avez-vous vu?	*Whom have you seen?*
De *qui* tenez-vous cette nouvelle?	*From whom have you this news?*
À *qui* est ce livre?	*Whose book is this?*

FURTHER USES OF THE PRONOUN EN.

En, used as an equivalent for the English *some* or *any*, expressed or understood, remains, however, an indirect object :—

Avez-vous des pommes?	*Have you apples?*
J'*en* ai.	*I have (I some have).*

En sometimes is used to avoid the repetition of the whole or part of a clause :—

L'on ne saurait voir, sans *en* être piqué, Posséder par un autre un bien qu'on a manque MOLIÈRE.	*We cannot, without being piqued, see another person in possession of goods which we have failed to obtain.*
N'*en* disputons plus ; chacun a sa pensée. MOLIÈRE.	*Let us no longer argue about this; everyone has his own opinion.*

FURTHER USES OF THE PRONOUN Y.

As you have already learnt, *y* means *to it*, *at it*, *to them*, *at them*. It is seldom used in relation to persons, but frequently in relation to things :—

Je reçois votre lettre, ma chère enfant, et j'*y* fais réponse avec précipitation. MME. DE SÉVIGNÉ.	*I receive your letter, my dear child, and answer it (make answer thereto) in haste.*
Tirer vanité de quelque chose, c'est prouver qu'on n'*y* est pas accoutumé. BOISTE.	*To feel vanity on account of anything is proving that we are not accustomed to it*
Chargez-vous de cette affaire; donnez-*y* tous vos soins. BONIFACE.	*Take this affair upon yourself; give all your care to it.*

THE INDEFINITE PRONOUN ON.

On, which is very extensively used in the French language, is said only of persons. Grammatically speaking, it is always of the masculine gender. *On* is used in French for *people*, *one*, *someone*, *we*, *they*, whenever these words have a general and indefinite meaning, and do not refer to any particular word :—

On pardonne aisément le mal involontaire. DE LA BOUTRAYE.	*We (people, they, etc.) easily forgive involuntary injuries.*
On cherche les rieurs, et moi je les evite. LA FONTAINE.	*People (they, we) seek laughing (or merry) people, and I avoid them.*

Another translation of the above sentences will show us that the pronoun *on* often enables the French to make use of the active voice in cases in which the passive voice would be used in English.* Thus the two examples last given may be rendered as follows :—

On pardonne aisément le mal involontaire.	*Involuntary injuries are easily forgiven.*
On cherche les rieurs, mais moi je les évite.	*The merry are generally sought; for my part, I avoid them.*
Quand *on* est chretien, de quelque sexe que *l'on* soit, il n'est pas permis d'être lâche. FÉNELON.	*A Christian of whichever sex is not allowed to be cowardly.*
On peut être honnête homme, et faire mal des vers. MOLIÈRE.	*One may be a worthy man, and make bad verses.*
On aime peu celui qui n'ose aimer personne. DELILLE.	*We feel but little love for him who dares love nobody.*
A-t-*on* jamais pleure d'avoir fait son devoir? CHAMFORT.	*Have we ever grieved on account of having done our duty?*
Quand *on* a même but, rarement *on* s'accorde. LEBRUN	*Those who have the same aim rarely agree.*
Artistes, écrivains, poètes, si vous vous copiez toujours, *on* ne vous copiera jamais BERNARDIN DE ST. PIERRE.	*Artists, writers, poets! if you always copy each other, no one will copy you.*

ALGEBRA.—XIII.

[*Continued from Vol. V., p. 345.*]

QUADRATIC EQUATIONS.

246. Equations are divided into classes, which are distinguished from each other by the power of the letter that expresses the unknown quantity. Those which contain only the *first* power of the unknown quantity are called *simple* equations, or equations of the first degree. Those in which the highest power of the unknown quantity is a *square*, are called *quadratic*, or equations of the *second degree*; those in which the highest power is a *cube*, are called *cubic*, or equations of the *third degree*, etc.

Thus $x = a + b$ is an equation of the *first* degree; $x^2 = c$, and $x^2 + ax = d$, are *quadratic* equations, or equations of the *second* degree; $x^3 = h$, and $x^3 + ax^2 + bx = d$, are *cubic* equations, or equations of the *third* degree.

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* **On dit**, *it is said*; **on rapporte**, *it is related*; **on craint**, *it is feared*, etc. **Cela se fait ainsi** (*literally, that makes itself thus*), *that is made in this manner*, etc.

247. Equations are also divided into *pure* and *adfected* equations. A pure equation contains only *one power* of the unknown quantity. This may be the first, second, third, or any other power. An adfected equation contains *different powers* of the unknown quantity. Thus,

$$\begin{cases} x^2 = d - b, \text{ is a pure quadratic equation.} \\ x^2 + bx = d, \text{ an adfected quadratic equation.} \end{cases}$$

$$\begin{cases} x^3 = b - c, \text{ a pure cubic equation.} \\ x^3 + ax^2 + bx = h, \text{ an adfected cubic equation.} \end{cases}$$

In a *pure* equation, all the terms which contain the unknown quantity may be united in one, and the equation, however complicated in other respects, may be reduced by the rules which have already been given. But in an *adfected* equation, as the unknown quantity is raised to *different powers*, the terms containing these powers cannot be united.

ADFECTED QUADRATIC EQUATIONS.

248. *An adfected quadratic equation is one which contains the unknown quantity in one term, and the square of that quantity in another term.*

The unknown quantity may be originally in *several* terms of the equation. But all these terms can be reduced to two, one containing the unknown quantity, and the other its square.

It has already been shown that a *pure* quadratic is solved by *extracting the root of both sides of the equation*. An *adfected* quadratic may be solved in the same way, if the member which contains the unknown quantity is an *exact square*.

Thus the equation $x^2 + 2ax + a^2 = b + h$ may be reduced by evolution. For the first member is the *square* of a *binomial* quantity, and its root is $x + a$. Therefore,

$$x + a = \sqrt{b + h}, \text{ and by transposing } a,$$
$$x = \sqrt{b + h} - a.$$

But it is not often the case that the member of an adfected quadratic containing the unknown quantity is an *exact square*, till an additional term is supplied for the purpose of making the required reduction.

In the equation $x^2 + 2ax = b$, the side containing the unknown quantity is not a complete square. The two terms of which it is composed are indeed such as might belong to the square of a binomial quantity. But one term is *wanting*. We have then to inquire, in what way this may be supplied. From having *two* terms of the square of a binomial given, how shall we find the *third?*

Of the three terms, two are complete powers, and the other is twice the product of the roots of these powers, or, which is the same thing, the product of one of the roots into twice the other.

In the expression $x^2 + 2ax$, the term $2ax$ consists of the factors $2a$ and x. The latter is the unknown quantity. The other factor $2a$ may be considered the *coefficient* of the unknown quantity; a coefficient being another name for a factor. As x is the root of the first term x^2, the other factor $2a$ is *twice* the root of the third term, which is wanted to complete the square. Therefore *half* of $2a$ is the root of the deficient term, and a^2 is the term itself.

The square completed is $x^2 + 2ax + a^2$, where it will be seen that the last term a^2 is the square of half of $2a$, and $2a$ is the coefficient of x, the root of the first term.

In the same manner it may be proved that the last term of the square of any binomial quantity is equal to the square of half the coefficient of the root of the first term.

249. From this principle is derived the following

METHOD FOR COMPLETING THE SQUARE.

Take the square of half the coefficient of the first power of the unknown quantity, and add it to both sides of the equation.

It will be observed that there is nothing *peculiar* in the solution of *adfected quadratics*, except the *completing of the square*. *Quadratic* equations are *formed* in the same way as *simple* equations; and, after the square is completed, they are reduced in the same manner as pure equations.

EXAMPLE.

Reduce the equation $x^2 + 6ax = b$.
Completing the square, $x^2 + 6ax + 9a^2 = 9a^2 + b$.
Extracting the root of both sides, $x + 3a = \pm\sqrt{9a^2 + b}$.
And $x = -3a \pm \sqrt{9a^2 + b}$. *Ans.*

Here the coefficient of x, in the given equation, is $6a$.

The square of half this is $9a^2$, which being added to both sides completes the square. The equation is then reduced by extracting the root of each member.

EXERCISE 62.

1. Reduce the equation $x^2 - 8bx = h$.
2. Reduce the equation $x^2 + ax = b + h$.
3. Reduce the equation $x^2 - x = h - d$.
4. Reduce the equation $x^2 + 3x = d + c$.
5. Reduce the equation $x^2 - abx = ab - cd$.
6. Reduce the equation $x^2 + \frac{ax}{b} = h$.
7. Reduce the equation $x^2 - \frac{x}{b} = 7h$.
8. Reduce the equation $x^2 + ax - x = b$.

250. In these and similar instances, the root of the third term of the completed square is easily found, because this root is the same half coefficient from which the term has just been derived. Thus, in the seventh example, half the coefficient of x is $\frac{1}{2b}$, and this is the root of the third term $\frac{1}{4b^2}$.

When the first power of the unknown quantity is in *several terms*, these should be united in one, if this can be done by the rules for reduction in addition. But if there are *literal* coefficients, these may be considered as constituting, together, a *compound* coefficient or factor, into which the unknown quantity is multiplied.

Thus $ax + bx + dx = (a + b + d) \times x$. The square of half this compound coefficient is to be added to both sides of the equation.

EXAMPLES.

1. Reduce the equation $x^2 + 3x + 2x + x = d$.
Uniting terms, $x^2 + 6x = d$.
Completing the square, $x^2 + 6x + 9 = 9 + d$.
And $x = -3 \pm \sqrt{9 + d}$. *Ans.*

2. Reduce the equation $x^2 + ax + bx = h$.
$x^2 + (a + b) \times x = h$.
Therefore

$$x^2 + (a + b) \times x + \left(\frac{a + b}{2}\right)^2 = \left(\frac{a + b}{2}\right)^2 + h.$$

$$x = \sqrt{\left(\frac{a + b}{2}\right)^2 + h} - \frac{a + b}{2}.$$

Before completing the square, the known and unknown quantities must be brought on opposite sides of the equation by transposition; the square of the unknown quantity must also be *positive*, and it is preferable to make it the *first* or *leading* term.

EXAMPLE.

Reduce the equation $a + 5x - 3b = 3x - x^2$.
Transposing and uniting terms, $x^2 + 2x = 3b - a$.
Completing the square, $x^2 + 2x + 1 = 1 + 3b - a$.
And $x = -1 \pm \sqrt{1 + 3b - a}$. *Ans.*

If the *highest power* of the unknown quantity has a *coefficient*, or *divisor*, before completing the square it must be freed from these by multiplication or division.

EXAMPLE.

Reduce the equation $x^2 + 24a - 6h = 12x - 5x^2$.
Transposing and uniting terms, $6x^2 - 12x = 6h - 24a$.
Dividing by 6, $x^2 - 2x = h - 4a$.
Completing the square, $x^2 - 2x + 1 = 1 + h - 4a$.
Extracting and transposing, $x = \pm 1\sqrt{1 + h - 4a}$. *Ans.*

If the square of the unknown quantity is in *several terms*, the equation must be divided by *all* the coefficients of this square.

EXAMPLE.

Reduce the equation $bx^2 + dx^2 - 4x = b - h$.
Dividing by $b + d$, $x^2 - \frac{4x}{b + d} = \frac{b - h}{b + d}$.

Given $ax^2 + bx = d$, to find x.

If this equation is multiplied by $4a$, and if b^2 is added to both sides, it will become

$$4a^2x^2 + 4abx + b^2 = 4ad + b^2;$$

the first member of which is a complete square of the binominal $2ax + b$.

EXERCISE 63.

1. Reduce the equation $\frac{x}{2} = \frac{36}{x + 2} - 4$.
2. Reduce the equation $h + 2x = d - \frac{bx^2}{a}$.
3. Reduce the equation $ax^2 + x = h + 3x - x^2$.

251. From the foregoing principle is deduced

A SECOND METHOD OF COMPLETING THE SQUARE, called the Hindoo method.

Multiply the equation by 4 times the coefficient of the highest power of the unknown quantity, and add to both sides the square of the coefficient of the lowest power.

The peculiar advantage of the Hindoo method is, that it avoids the introduction of *fractions* in completing the square.

DEMONSTRATION.

1. The object of multiplying the equation by the *coefficient* of the *highest power* is to render the first term a perfect square without removing its coefficient, and at the same time to obtain the middle term of the square of a binomial. But we must multiply all the terms of the equation by this quantity to preserve the equality of its members. Thus the equation $ax^2 + bx = d$, when multiplied by a, becomes $a^2x^2 + abx = ad$.

That the first term will, in all cases, be rendered a complete square when multiplied by its coefficient, is evident from the fact that it will then consist of two factors, each of which is a square, viz., x^2, and the square of its coefficient. But the product of the squares of two or more factors is equal to the square of their product.

2. It will be seen that one term is still wanting in the first member in order to make it the square of a binomial, viz., the square of the last term.

This deficiency may be supplied by adding to both sides the square of half the coefficient of the lowest power, as in the first method of completing the square. But in taking half of this coefficient, the learner will often be encumbered with fractions which it is desirable to avoid. Thus, in the equation above, half of the coefficient of the lowest power is $\frac{b}{2}$, the square of which is $\frac{b^2}{4}$. Adding this to both sides, the equation will become $a^2x^2 + abx + \frac{b^2}{4} = ad + \frac{b^2}{4}$, the first member of which is a complete square of the binomial, $ax + \frac{b}{2}$.

Now it is obvious to the student that multiplying the equation by 4 has precisely the same effect as removing the denominator 4 from the third term. Hence, if we multiply the equation by 4, we not only avoid the introduction of fractions, but also leave the square of the whole of the coefficient of the lowest power to be added to both sides according to the rule.

The first term evidently continues to be a square after it is multiplied by 4, for it is still the product of the *powers* of certain factors.

3. It will be perceived at once, that the second term is composed of twice the root of the first term multiplied into the coefficient of the last term, which constitutes the middle term of a binomial square.

Observation.—It is manifest from the preceding demonstration, that multiplying by 4 is not a *necessary* step in completing the square, but is resorted to on this particular occasion as an expedient to prevent the occurrence of fractions When, therefore, the coefficient of the lowest power is an *even* number, so that half of it can be taken without a remainder, we may *simplify* the operation by multiplying by the coefficient of the highest power alone, and adding to both sides the square of half the coefficient of the lowest power of the unknown quantity.

EXAMPLE.

Take the equation $7x^2+40x=71\frac{3}{7}$.
Multiplying by 7 it becomes $49x^2+280x=500$.
Adding the square of half the coefficient, $49x^2+280x+400=900$.
By evolution and transposition, $7x=10$, or $x=1\frac{3}{7}$.

252. From the principles that have been laid down in the preceding lesson we may also deduce

OTHER METHODS OF COMPLETING THE SQUARE.

Multiply the equation by* 16 *times the coefficient of the highest power of the unknown quantity, and add to both sides* 4 *times the square of the coefficient of the lowest power.

And universally, multiplying the equation by the product of any square number, as* n², *into the coefficient of the highest power, and adding to both sides the square of half the root of this number into the square of the coefficient of the lowest power, will render it a complete square.

EXAMPLES.

1. Take the equation $x^2-3x=4$.
Multiplying by 16, etc., $16x^2-48x+36=64+36=100$.
By evolution and transposition, $x=4$, or -1.

2. Take the equation $ax^2+cx=d$.

Multiplying by n^2a, etc., $n^2a^2x^2 + n^2acx + \frac{n^2c^2}{4} = n^2ad + \frac{n^2c^2}{4}$, the first member of which is the square of the binomial, $nax + \frac{nc}{2}$; and from which we obtain $x = \frac{\pm\sqrt{c+4ad}-c}{2a}$.

There is an *obvious advantage*, however, in employing 4 in preference to any other square number. For multiplying the equation by 4 times the coefficient of the highest power, will produce the *middle* term of a binomial square, the *third* term of which is the square of the coefficient of the lowest power.

In the square of a binomial, the first and last terms are always *positive*. For each is the square of one of the terms of the root, and all even powers are positive.

If, then, $-x^2$ *occurs in an equation, it cannot with this sign form a part of the square of a binomial* But if *all* the signs in the equation be changed, whilst the equality of the sides will be preserved, the term $-x^2$ will become positive, and the square may then be completed.

EXAMPLE.

Reduce the equation $-x^2+2x=d-h$.
Changing all the signs, $x^2-2x=h-d$.

In a quadratic equation the first term x^2 is the square of a single letter. But a binomial quantity may consist of terms, one or both of which are already powers.

Thus, $x^3 + a$ is a binomial, and its square is $x^6 + 2ax^3 + a^2$, where the index of x in the first term is twice as great as in the second. When the third term is deficient, the square may be completed in the same manner as that of any other binomial. For the middle term is twice the product of the roots of the two others.

So the square of $x^n + a$, is $x^{2n} + 2ax^n + a^2$.

And the square of $x^{\frac{1}{n}} + a$, is $x^{\frac{2}{n}} + 2ax^{\frac{1}{n}} + a^2$.
Therefore

Any equation which contains only two different

powers or roots of the unknown quantity, the index of one of which is twice that of the other, may be solved in the same manner as a quadratic equation, by completing the square.

N.B. It must be observed that in the binomial root, the latter expressing the unknown quantity may still have a fractional or integral index, so that a further operation may be necessary.

EXAMPLE.

Reduce the equation $x^4 - x^2 = b - a.$

Completing the square, $x^4 - x^2 + \frac{1}{4} = \frac{1}{4} + b - a.$

Extracting and transposing, $x^2 = \frac{1}{2} \pm \sqrt{\frac{1}{4} + b - a.}$

Extracting again, $x = \pm \sqrt{\frac{1}{2} \pm \sqrt{(\frac{1}{4} + b - a)}}.$

EXERCISE 64.

1. Reduce the equation $ax^2 + dx = h.$
2 Reduce the equation $3x^2 + 5x = 42$
3. Reduce the equation $x^2 - 15x = -54$
4. Reduce the equation $4x - x^2 = -32$
5. Reduce the equation $x^{2n} - 4bx^n = a$
6. Reduce the equation $x + 4\sqrt{x} = h - n.$
7. Reduce the equation $x^{\frac{2}{n}} + 8^{\frac{1}{n}} = a + b.$

253. The solution of a quadratic equation, whether pure or adfected, gives two results. For after the equation is reduced, it contains an ambiguous root. In a *pure* quadratic, this root is the *whole* value of the unknown quantity.

Thus the equation $x^2 = 64,$

Becomes, when reduced, $x = \pm \sqrt{64};$

that is, the value of x is either + 8 or − 8, for each of these is a root of 64. Here both the values of x are the same, except that they have contrary signs. This will be the case in every pure quadratic equation, because the whole of the second member is under the radical sign. The two values of the unknown quantity will be alike, except that one will be positive and the other negative.

But in *adfected* quadratics, a *part* only of one side of the reduced equation is under the radical sign. When this part is added to, or subtracted from, that which is without the radical sign, the two results will differ in quantity, and will have their signs in some cases alike, and in others unlike.

EXAMPLES.

Thus the equation $x^2 + 8x = 20,$

Becomes, when reduced, $x = -4 \pm \sqrt{16 + 20}.$

That is, $x = -4 \pm 6.$

$$\left.\begin{array}{ll}\text{Here the first value of } x \text{ is} & -4 + 6 = +\ 2 \\ \text{And the second is} & -4 - 6 = -10\end{array}\right\}\ \text{One positive and the other negative.}$$

Also the equation $x^2 - 8x = -15,$

Becomes, when reduced, $x = 4 + \sqrt{16 - 15}.$

That is, $x = 4 \pm 1.$

$$\left.\begin{array}{ll}\text{Here the first value of } x \text{ is} & 4 + 1 = +\ 5 \\ \text{And the second is} & 4 - 1 = +\ 3\end{array}\right\}\ \text{both positive.}$$

That these two values of x are correctly found, may be proved by substituting first one and then the other, for x itself, in the original equation.

Thus $5^2 - 8 \times 5 = 25 - 40 = -15,$

And $3^2 - 8 \times 3 = 9 - 24 = -15.$

In the reduction of an adfected quadratic equation, the value of the unknown quantity is frequently found to be ***imaginary***.

Thus the equation $x^2 - 8x = -20,$

Becomes, when reduced, $x = 4 + \sqrt{16 - 20}.$

That is $x = 4 \pm \sqrt{-4}.$

Here the root of the negative quantity − 4 cannot be assigned, and therefore the value of x cannot be found. There will be the same impossibility in every instance in which the negative part of the quantities under the radical sign is greater than the positive part.

When *one* of the values of the unknown quantity in a quadratic equation is imaginary, the *other* is so also. For both are equally affected by the imaginary root

Thus, in the example above,

The first value of x is $4 + \sqrt{-4},$

And the second is $4 - \sqrt{-4};$ each of which contains the imaginary quantity $\sqrt{-4}.$

254. An equation which, when reduced, contains an imaginary root, is often of use to enable us to determine whether a proposed question admits of an answer, or involves an absurdity.

EXAMPLE.

Suppose it is required to divide 8 into two such parts that the product will be 20.

If x is one of the parts, the other will be $8 - x.$

By the conditions proposed $(8 - x) \times x = 20.$

This becomes, when reduced, $x = 4 \pm \sqrt{-4}.$

Here the imaginary expression $\sqrt{-4}$ shows that an answer is impossible; and that there is an absurdity in supposing that 8 may be divided into two such parts that their product shall be 20.

255. Although a quadratic equation gives two results, yet both these may not always be applicable to the subject proposed. The quantity under the radical sign may be produced either from a positive or a negative root. But both these roots may not, in every instance, belong to the problem to be solved.

EXAMPLE.

Divide the number 30 into two such parts that their product may be equal to 8 times their difference.

If $x =$ the less, then $30 - x =$ the greater part.

By the supposition, $x \times (30 - x) = 8 \times (30 - 2x)$.

This reduced, gives $x = 23 \pm 17 = 40$, or 6, the less part.

But as 40 cannot be part of 30, the problem can have but one real resolution, making the less part 6, and the greater part 24.

256. The preceding principles in quadratic equations may be summed up in the following

GENERAL RULE.

1. *Transpose all the unknown quantities to one side of the equation, and the known quantities to the other.*

2. *Make the square of the unknown quantity positive* (if it is not already) *by changing the signs of all the terms on both sides; and place it for the first or leading term.*

3. To complete the square,

(1) *Remove the coefficient of the second power of the unknown quantity, and add the square of half of the coefficient of the first power of the unknown quantity to both sides of the equation.*

(2) *Or multiply the equation by four times the coefficient of the highest power of the unknown quantity, and add to both sides the square of the coefficient of the first power of the unknown quantity.*

4. *Reduce the equation by extracting the square root of both sides; and transpose the known part of the binomial root thus obtained to the opposite side.*

EXERCISE 65.

Reduce the following equations:—

1. $3x^2 - 9x - 4 = 80$.
2. $4x - \frac{36 - x}{x} = 46$.
3. $4x - \frac{14 - x}{x + 1} = 14$.
4. $5x - \frac{3x - 3}{x - 3} = 2x + \frac{3x - 6}{2}$.
5. $\frac{16}{x} - \frac{100 - 9x}{4x^2} = 3$.
6. $\frac{3x - 4}{x - 4} + 1 = 10 - \frac{x - 2}{2}$.
7. $\frac{x + 4}{3} - \frac{7 - x}{x - 3} = \frac{4x + 7}{9} - 1$.
8. $\frac{x^3 - 10x^2 + 1}{x^2 - 6x + 9} = x - 3$.
9. $\sqrt{x^3} - 2\sqrt{x} = x$.
10. $\frac{x}{2} - 22\frac{1}{2} = \frac{\sqrt{x}}{3}$.
11. $x^3 - x^{\frac{3}{2}} = 56$.
12. $3x^{\frac{3}{4}} + x^{\frac{3}{2}} = 3104$.
13. $x + 5 = \sqrt{x + 5} + 6$.
14. $x^2 - 2x + 6\sqrt{x^2 - 2x + 5} = 11$.
15. $x - 1 = 2 + \frac{2}{\sqrt{x}}$.
16. $x^4 - 2x^3 + x = 132$.
17. $x = \frac{12 + 3\sqrt{x}}{x - 5}$.
18. $x^{2n} - mx^n = p$.
19. $\frac{x^4}{2} + \frac{17x^3}{4} - 17x = 8$.
20. $\sqrt[3]{x^3 - a^3} = x - b$.
21. $\frac{\sqrt{4x} + 2}{4 + \sqrt{x}} = \frac{4 - \sqrt{x}}{\sqrt{x}}$.
22. $x^{\frac{2}{3}} + x^{\frac{1}{3}} = 756$.
23. $\sqrt{2x+1} + 2\sqrt{x} = \frac{21}{\sqrt{(2x + 1)}}$.
24. $2\sqrt{x - a} + 3\sqrt{2x} = \frac{7a + 5x}{\sqrt{(x - a)}}$.
25. $x + 16 - 7\sqrt{x + 16} = 10 - 4\sqrt{x + 16}$.
26. $\sqrt{x^5} + \sqrt{x^3} = 6\sqrt{x}$.
27. $\frac{4x - 5}{x} - \frac{3x - 7}{3x + 7} = \frac{9x + 23}{13x}$.
28. $\frac{3}{6x - x^2} + \frac{6}{x^2 + 2x} = \frac{11}{5x}$.
29. $(x - 5)^3 - 3(x - 5)^{\frac{3}{2}} = 40$.
30. $x + \sqrt{x + 6} = 2 + 3\sqrt{x + 6}$

KEY TO EXERCISES.

EXERCISE 55.

1. $a\sqrt{2a}$.
2. $\sqrt{hx}$.
3. $(a^2 + x)^{\frac{1}{2}}$.
4. $\left(\frac{a^2h}{x}\right)^{\frac{1}{m}}$.
5. $(ay)^{\frac{1}{2}}$.
6. $(3a)^{\frac{1}{3}}$.
7. $(ax)^{\frac{1}{3}}$.
8. $a^{\frac{m}{mn}}$.
9. $(b + y)^{\frac{1}{n}}$.
10. $(r^2y^3)^{-\frac{2}{3}}$.
11. $4x\sqrt{y}$.
12. $9d\sqrt{b}$.
13. $b(a^2x)^{\frac{1}{n}}$.
14. $4\sqrt{2}$.
15. $b\sqrt{x}$.

EXERCISE 56.

1. $\frac{1}{3}\sqrt[6]{\frac{b^2}{a^2c}}$.
2. $\sqrt[3]{4}$.
3 $\frac{3}{7}\sqrt[3]{441}$.
4. $\sqrt{2}$.
5. $\sqrt[3]{4}$.
6. $a^{\frac{1}{3}}$.
7. $a^{\frac{1}{4}}$.
8. $2\sqrt{3}$.
9. $x^3\sqrt{-1}$.
10. $\sqrt[4]{7}$.
11. $\frac{b}{2x^3}\sqrt[6]{b^5x^5}$.
12. $\frac{1}{3}\sqrt[6]{500}$.

EXERCISE 57.

1. $a^{\frac{3}{4}}$.
2. $a^{\frac{n}{m}}$.
3. $a^{\frac{1}{3}}y^{\frac{1}{3}}$.
4. $a^{\frac{n}{n}}x^{\frac{n}{m}}$.
5 $a^{\frac{4}{3}}x^{\frac{3}{4}}$.
6. a.
7. a.
8. $a^{mn}x^{\frac{n}{mn}}$.
9 $a^2(x - y)$.
10. $27a^3y$.
11. $a^3 - 3ab^2 - (3a^2b - b^3)\sqrt{-1}$.
12. $a^3 - 3a^2\sqrt{b} + 3ab - b\sqrt{b}$.
13. d^2.
14 $x^2 - 2x + 1$.
15 $(a + b)^3$.

EXERCISE 58.

1 $a^{\frac{1}{3}}(xy)^{\frac{1}{4}}$ or $(a^2xy)^{\frac{1}{3}}$.
2. $n(a^6by)^{\frac{1}{6n}}$.
3. $(a^3b)^{\frac{1}{12}}$.
4. $2\sqrt[49]{d}$.
5. $8\sqrt{a}$.
6. $(a + b)^{\frac{1}{3}}$.
7. $(x - y)^{\frac{1}{6n}}$.
8. $-5ax^2$.
9. $\frac{2a^2}{3xy}$.
10. $x - 3b$.
11. $\frac{2ax^2}{3}$.
12. $a + \frac{y}{2}$.
13. $(a^6x^{12})^{\frac{1}{6}}$.
14. $\sqrt[3]{-27y^3}$.
15. $a^{\frac{6}{3}}$ and $a^{\frac{1}{3}}$.
16. $4^{\frac{4}{12}}$ and $5^{\frac{3}{12}}$
17. $(a^4)^{\frac{1}{4}}$ and $(b^2)^{\frac{1}{4}}$.
18. $(16)^{\frac{1}{4}}$ and $(16)^{\frac{1}{4}}$.
19. $7\sqrt{6}$.
20. $x\sqrt{x - a^2}$.
21. $6a\sqrt{x}$ and $2a\sqrt{x}$.
22. $6\sqrt[3]{3}$ and $2\sqrt[3]{3}$.
23. $70\sqrt[3]{9}$.
24. 4.
25. $6 + 2\sqrt{-2} - 9\sqrt{-1} + 3\sqrt{2}$.
26. $a^2 + b^2c$.
27. $\sqrt[6]{2}$.
28. $\frac{1}{3}(55296)^{\frac{1}{12}}$.
29 $\sqrt[20]{648}$.
30. $2\sqrt[4]{12}$.
31. $54\sqrt{2}$.
32 $7 + 4\sqrt{3}$.
33. $17 + 12\sqrt{2}$.
34. $38 + 17\sqrt{5}$.

EXERCISE 59.

1. 63.
2. $4\frac{2}{35}$.
3. $684\frac{1}{4}$.
4. 200.
5. 20.
6. $80\frac{1}{4}$.
7. 4.
8. 8.
9. $\left(\frac{c^2 + b - a}{2c}\right)^2 - b$.
10. $\frac{c^2}{a - b}$.
11. 4.
12. $\frac{a}{3}$.
13. $\frac{a}{\sqrt{3}}$.
14. $\frac{b^2 - 4a^2}{4a}$.
15. $\frac{3}{4}$.
16. 81.
17. 16.
18. 6.

EXERCISE 60.

1. $\sqrt{\frac{2c + d}{a - b}}$.
2. $\sqrt[n]{\frac{10 - a}{d + 1}}$.
3. $\sqrt[n]{(h - d)^n + a}$.
4. $\pm\sqrt{a^2 - b^2}$.
5. 3.
6. 6.
7. $a + b$.
8. 11.
9. 20.

EXERCISE 61.

1. £400
2. 12 miles.
3. 16.
4. 4.
5. ± 9 and ± 21.
6. ± 14 and ± 18.
7. 10 and 8.
8. 8 and 6.
9. 15 and 12.
10. A went 72 miles; B, 54. Whole distance = 126 miles.
11. ± 24 and ± 15.
12. 24 and 12.
13. 6 and 4.
14 12.
15. 12.

APPLIED MECHANICS.—II.

[*Continued from Vol. V., p.* 341.]

DEDUCTIONS FROM EXPERIMENTS—DEFECTS IN APPARATUS—TABULATION AND CORRECTION OF RESULTS—MODERN METHODS—THE USE OF SQUARED PAPER—EXAMPLES OF PLOTTING QUANTITIES AND DRAWING CURVES.

We hope that every student who reads these lessons will regard the quantities dealt with as *measurable* quantities, and will be sceptical as to the truth of every law or hypothesis advanced, until he has tried whether it is in accord with the results he obtains by actual experiment. I do not say that any rough piece of apparatus he may arrange will give results sufficiently accurate to *prove* or disprove any law, but if he finds that his experiments *illustrate* some principle otherwise deduced, he has a confidence in applying that principle which he could not otherwise obtain. Apart altogether from this, the careful analysis and systematic arrangement of, and deduction from, experimental results, is in itself a most valuable training. Experiment is one of the most useful of all methods of education, and this is especially true in anything relating to such a practical subject as engineering.

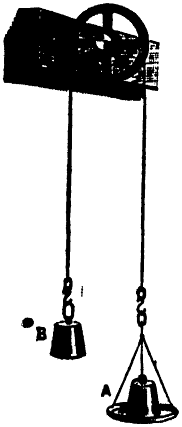


Fig. 11.

We assume that the reader is of that practical and inquiring turn of mind which is indispensable to a successful experimenter, and that he will not only carry out all the experiments we shall describe, but note every circumstance—favourable or otherwise—which may occur in the course of an experiment. Thus, in the experiment illustrating the law of the "triangle of forces," it is usually found that the result is not in strict accordance with the law, but that the "discrepancy" is smaller the more carefully the experiment is performed and the more perfect the apparatus is. To what then, the inquiring student will ask, is the discrepancy due? It is probably due to our having made some assumptions which are not quite correct. For instance, we assumed that the pull in the cord on both sides of one of the pulleys is the same, or rather that the pull in the cord at P is accurately that due to the weight it bears, which is not correct, as may be seen by making an experiment on the pulley itself. Let the pulley be fixed as shown in Fig. 11. Passing a cord, with a scale-pan for weights at each end, over the pulley and putting equal weights into the two pans there is equilibrium. But there is also balance if one of the weights is slightly increased, and in this case the pull in the cord is *different* on the two sides of the pulley. This difference is due to what may be called the *friction* of the pulley, and the discrepancy noticed in the previous experiment was owing to our assumption that the pulley was of that ideal kind only met with in books on mechanics, viz., "without friction." All pulleys *have* friction, and it is better to take it into account and to find out all we can about it. For instance, if the equal weights in the scale-pans (Fig. 11) be increased, the excess weight must be increased also if a motion downwards of that scale-pan is to be kept up *steadily*. Increase both loads equally, and find in each case what excess weight is required to *keep up a steady uniform motion*, for that is the best test of the force required to overcome friction. If the weights in the two scale-pans are denoted by the letters A and B respectively, some such numbers as the following will be obtained:—

Weight, A.	Weight, B.	Effect of Friction, F.
23·4	20	3·4
44·7	40	4·7
65·4	60	5·4
86·8	80	6·8
107·5	100	7·5
128·8	120	8·8
149·6	140	9·6
171·0	160	11·0

It is evident that there is some kind of law connecting the friction of the pulley with the load on it; what is this law, or how shall we obtain it? This brings us to a most important part of our subject—

THE USE OF SQUARED PAPER.

When an experimenter has obtained numerical values of two quantities which are connected in such a way that any change in one is accompanied by a corresponding change of some kind in the other, his next care is generally to find out what the law of dependence of the one quantity on the other is, and to express that law in some way. Fifty, or even twenty, years ago such a law was generally put in the form of a mathematical formula or equation, usually cumbrous in form, arrived at by great labour and trouble, and equally difficult to apply to any practical purpose. Nowadays, the connection or law is usually shown *graphically* by a curve drawn on squared paper. This has all the advantages of exhibiting to the eye a *map* or *picture* of the law of variation; the risk of serious error in getting out the law is reduced, errors of observation are to a great extent eliminated, and last, but not least—as a recent writer puts it—"the student in drawing the curve is constantly on a voyage of discovery, and has all the stimulus and pleasure of an original investigation."

I wish, therefore, to give the student some examples in the use of this great aid to modern research—*a sheet of squared paper*, and to explain to the reader who is unacquainted with its use how he should proceed.

A sheet of squared paper may be bought for a halfpenny or less; it is crossed by a large number of equidistant lines at right angles to each other, thus covering the paper with little squares. Usually every tenth line, both vertically and horizontally, is of a different colour from the rest, merely for the purpose of preventing confusion, and enabling the number of lines or squares to be readily reckoned. The lowest horizontal line on the paper is usually taken as one *axis* or line of reference, and the vertical line nearest the left-hand side of the paper as the other axis, except in the case of complicated curves, when the axes should be in the middle of the sheet. Distances along the horizontal axis represent values of one quantity, whilst distances along the vertical axis represent values of the other quantity, or *variable* plotted; these distances are measured by the number of little squares from the *origin* or point where the two axes intersect. Each little square may represent one or more units of the quantity, according to the scale to which the diagram is to be drawn. The distances, or quantities represented, go in pairs, each pair intersecting in a point of which those distances are called the co-ordinates, and for distinction the vertical one is usually called the *ordinate* of the point—denoted by the letter y—the horizontal distance, its abscissa, denoted by the letter x. When a number of pairs of values are thus plotted, a number of *points* are obtained, which when joined by a curve give the picture or trace of the law sought. Quite different scales may be adopted for the horizontal and vertical measurements; *i.e.*, the horizontal scale may be different from the vertical one.

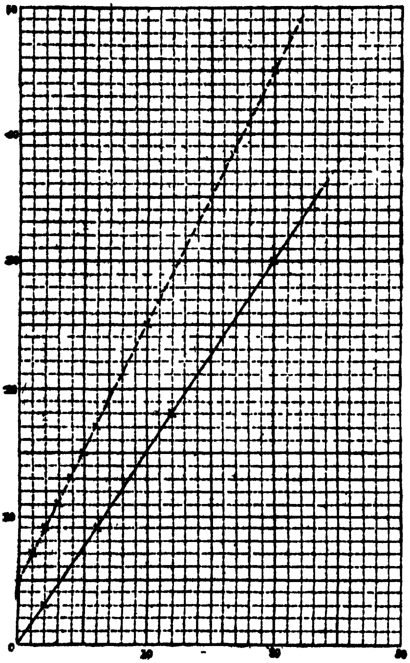


Fig. 12

Of course in plotting two definite quantities like the friction and load of a machine, the co-ordinates have definite meanings, and the symbols x and y are not required. The student will best grasp the meaning of these statements by following us carefully in a few examples. Thus, plot the points whose abscissæ and ordinates are respectively (2, 3), (6, 9), (12, 18), (20, 30).

These points are shown plotted in Fig. 12, and it is evident that they lie on a straight line which passes through the point o or origin. In this case the law is a very simple one, for whatever point on the line be taken, its y or ordinate is always 1½ times its x or abscissa; hence the law is $y = \frac{3}{2}x$.

This, then, is the simplest of all curves—a curve of the "first degree," and if the quantities found in an experiment are connected by such a simple law, the work is very easy indeed. The student should now plot the curves representing the following laws.—

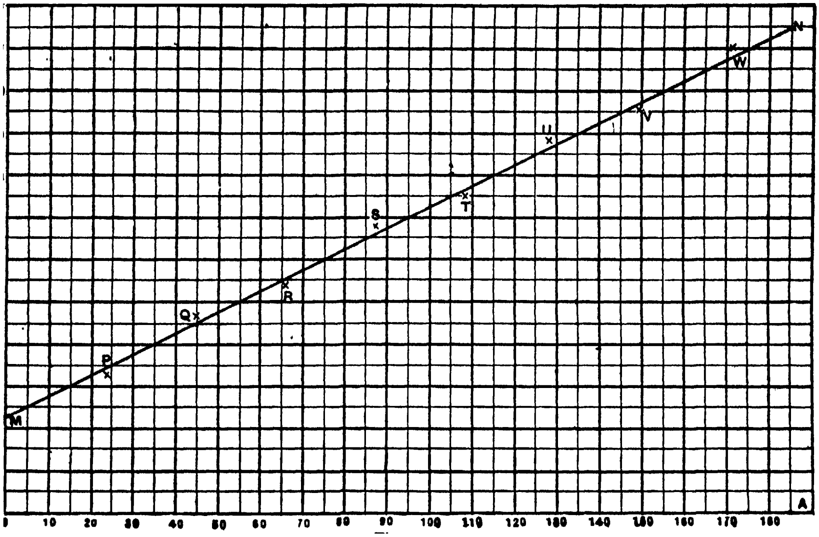
(1) $y = 10$.
(2) $x = 25$.
(3) $y = x$.
(4) $y = 2x + 5$.

The general law of a straight line is $y = ax + b$, where a and b are numbers; a has to do with the slope of the line, and b with the distance from the origin of the point in which it cuts the vertical axis. This can best be explained by working out one of the examples, say No. 4.

Law, $y = 2x + 5$; giving to x any value, a corresponding value of y is obtained. Such values are given in the following table:—

x			
1	7	5	15
2	9	6	17
3	11	10	25
4	13	20	45

The line passing through these points is shown dotted in Fig. 12. We see that it cuts the vertical axis in the point 5, and, further, that if a horizontal line be drawn through that point, *the ratio of the height of any point above this line to the point's abscissa* or x is the multiplier or coefficient of x in the law. In this particular case the multiplier is 2, and it should be observed that if the line sloped the other way on the paper, viz., from right to left, the multiplier would be negative; also that the intercept b (in this case, 5) would be negative if measured from O *downwards*. We are now in a position to find the law connecting the quantities obtained from the experiment on a simple pulley, given at page 31. The numbers when plotted, as already described, give the points, P, Q, R, S, etc., in Fig. 13. These points do not seem at first sight to be on a straight line, but on stretching a black thread among them we find that they are pretty uniformly distributed on both sides of the thread, and that therefore the little discrepancies which appear are probably due to experimental errors.



By drawing our straight line or curve in the best mean position among the points, these unavoidable errors are to a great extent corrected, hence one very important purpose of our squared paper. To correct such mistakes by a mathematical method, such as the method of least squares, is a tedious process quite beyond the ordinary student. Referring to the figure, we see that ordinates are values of friction, F, and abscissæ values of load, A. Employing the method already explained, we proceed to

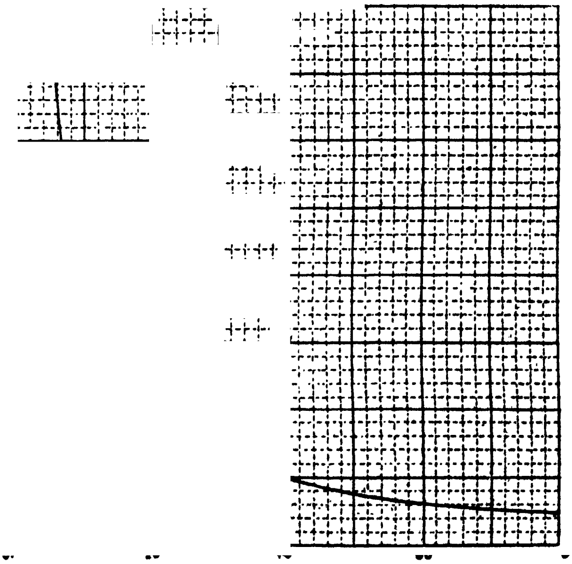


Fig. 14.

formulate the law connecting F and A. The line cuts the vertical axis at a point whose value is about 2·3, and taking a *point on the curve* just to the right of W, the ratio multiplier, already referred to, is found to be $\frac{8\cdot7}{175} = \cdot049$; hence the law sought is

$$F = \cdot049A + 2\cdot3.$$

This law tells us the force necessary to overcome the friction of the pulley when moving steadily with any given load, A, on it. In a similar way, the law connecting friction and A + B, the *total* load on the machine could be obtained, and the law would be of a similar kind. If A, B, and F are measured in pounds or ounces, the law tells us that 2·3 pounds or ounces, as the case may be, are required to move the machine steadily *without* load, and to overcome the friction due to its own weight.

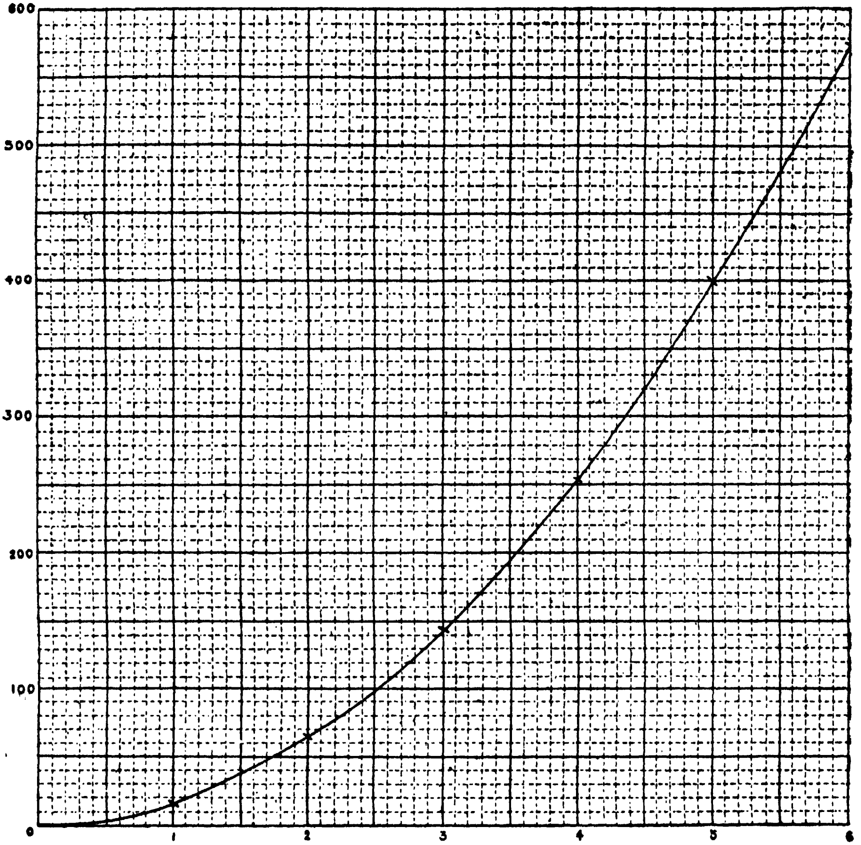


Fig. 15.

We need scarcely say that the numbers obtained from an experiment are often connected by a much more complicated law, but even in that case we can always *draw* or represent the law, though it may not be so easy to formulate it. Suppose, for example, we are told that a vessel contains 40 cubic feet of air or gas, and that the pressure of the gas is one pound per square inch, that when the volume of the gas is reduced to 20 cubic feet, its pressure is two pounds per square inch; to 10 cubic feet, its pressure is four pounds, and so on; what is the law connecting volume and pressure? The curve is shown in Fig. 14. It is a rectangular hyperbola, of which the law is $x \times y =$ some number; in this case

$$\text{pressure} \times \text{volume} = 40.$$

Just one more illustration before leaving this most important and interesting subject.

Suppose a stone is let fall from a height, and the times taken by it to fall certain distances are observed, then numbers of the following kind will be obtained:—

Time of falling, t.	Distance fallen, h.	Time of falling, t.	Distance fallen, h.
1	16	4	256
2	64	5	400
3	144	6	576

These when plotted give the curve shown in Fig. 15. It is a parabola, but only half of the curve is here shown. Its law is $y = ax^2$; in this case

$$h = 16t^2.$$

Practice in drawing curves will enable the student to identify their shapes in many cases, and so formulate the law if necessary and not too troublesome.

There are many uses to which curves may be put, in fact, *are* put, in the affairs of everyday life. They are employed to show the height of the barometer or the temperature at various times during the day or week, and we have heard of a merchant who thus kept a record of the price of a certain commodity as time went on. By a careful inspection of the curves for several years, he has been able on several occasions to foretell a rise or fall in price, and to make his arrangements accordingly. Difficult equations may be solved by the aid of a sheet of squared paper, and, in our opinion, this and kindred graphic methods will be more used in the future than at present. The student should carefully go through all the exercises which are appended.

Exercises.—Plot the curves whose laws are given below:—

(1) $x^2 + y^2 = 16$.
(2) $x^2 - y^2 = \pm 100$.
(3) $y = 3x^3$.
(4) $y = x^x$.

Plot the curves showing the relation of the following numbers:—

5. **THE COMPOUND INTEREST LAW.**—(*Interest added every instant.*)

TABLE SHOWING THE AMOUNT OF £100 INVESTED FOR n YEARS AT 5% COMPOUND INTEREST.

No. of years = n.	Amount, A, = principal + interest.	No. of years = n.	Amount, A, = principal + interest.
1	105·2	8	149·1
2	110·5	9	156·8
3	116·1	10	164·8
4	122·1	11	173·3
5	128·4	12	182·3
6	135·0	13	191·5
7	141·9	14	201·4

6. **THE CHARACTERISTIC CURVE OF A DYNAMO MACHINE.**—The following results were obtained by experimenting with a small dynamo, having a gramme armature and being "series" wound. They show the way in which the *total* E.M.F. of the machine varies with the current that it gives out. Mean speed = 1843 revolutions per minute.

Total E.M.F.	Current.	*Total* E.M.F.	Current.
0 volts.	0 amperes.	8·44 volts.	11·25 amperes
1·05 ,,	·75 ,,	8·007 ,,	12·00 ,,
2·614 ,,	2·25 ,,	9·366 ,,	13·5 ,,
4·196 ,,	3·75 ,,	10·12 ,,	15·75 ,,
5·376 ,,	5·25 ,,	10·754 ,,	18·00 ,,
6·35 ,,	6·75 ,,	11·21 ,,	20·25 ,,
7·14 ,,	8·25 ,,	11·382 ,,	22·5 ,,
7·812 ,,	9·75 ,,		

The above when plotted give the characteristic curve of the machine.

ITALIAN.—I.

INTRODUCTION.

WE propose to teach the grammar, structure, and vocabulary of the Italian language by a method not commonly adopted by the learned. Experience has convinced us that a strict adherence to scientific forms, though all-important in the cultivation of a language, does not tend to the advantage of the learner.

For its own intrinsic merits as a language, Italian deserves to be studied by everyone who would enjoy the pleasures of style, inexhaustible in variety. And they who would cultivate language for its excellence must seek that of Italy for the ideal beauty of expression.

Our method will be a natural, a simple, and, we trust, an easy one. We shall discard, as much as possible, all the conventional terms of grammar. Our grammatical progress will imitate the action of the mind in the formation of a sentence, with a due regard to peculiarities of idiom. We begin with the noun, as soon as we have clearly explained the principles of pronunciation; and we shall proceed at once to the verbs. The verb is the life of a language, and he who knows the verbs thoroughly has mastered the chief difficulty of his task. The remaining kinds of words will be taught and discussed in the same natural order.

ON THE PRONUNCIATION OF ITALIAN.

We shall teach the pronunciation of the Italian language in more detail than is generally pursued in English tuition. The profit to be derived from the study of any living language is much less if we are unable to pronounce it correctly. In reading the Italian poets, the pleasure does not consist altogether in appreciating the thoughts, or even shades of thoughts, but in the faculty to enjoy that divine harmony to which they have attuned the language. There is no insuperable or even very considerable difficulty in mastering Italian pronunciation; but a thoughtful attention to some leading principles, and a student-like diligence, are conditions essential to success.

A tolerable approach to accuracy in fixing pronunciation may be made by letter-signs representing analogous sounds familiar to the ear in one's own language. If one has made himself so familiar with the imitated sounds as to have acquired a considerable vocal command of the leading ones, he may very soon accurately and permanently acquire them by a few brief communications with an educated native.

Perhaps the most useful beginning we can make is to point out the leading errors which Englishmen commit in pronouncing Italian. In the mastery of the pronunciation of the Continental languages, and particularly of Italian, the Englishman's great difficulty is in the vowels.

The Englishman, perhaps from childhood, has heard no vowel sounds but those of his own island —his four sounds of *a*, his four sounds of *o*, his three sounds of *u*, his two sounds of *e*, and his two sounds of *i*—sounds little swayed by rule, and changing continually. He begins Italian, but carrying to the study the complex vocal habit of his language, it must be some time before he can comprehend and practise the simplicity and permanence of the sound of one Italian *a*, one Italian *i*, one Italian *u*, two Italian *e*'s, and two Italian *o*'s.

Another radical error committed by Englishmen in pronouncing Italian arises from two opposite principles, which may be said to be the fundamental rules of the accentuation of the languages. In English, every word has its leading, marked, or strongly accented syllable—generally speaking, the root of the word; and it follows that while this syllable is distinctly marked by the voice, the subordinate unaccented syllables fade away in the utterance into an airy nothingness that can hardly be described. It is quite different with Italian. It has its accented syllables just as in English, but the accent on the one does not destroy the vocal enunciation of the others. On the contrary, full and substantial justice must be done to every syllable, each being clearly sounded, full and roundly with the vowels, and in a resonant or vibrating tone with the consonants. The contrast may be observed in the pronunciation of any of the many words of a kindred sound in both languages derived from the same classic stock. Take the following:—

English.	*Italian.*
Difficulty.	*Dif-fi-col-tà.*
Voluntarily.	*Vo-lon-ta-ria-men-te.*
Detestably.	*De-te-sta-bil-men-te.*
Generously.	*Ge-ne-ro-sa-men-te.*
Indifferently.	*In-dif-fe-ren-te-men-te.*
Repetition.	*Ri-pe-ti-zi-o-ne.*

A third and radical difference between the two languages, as regards the principles of pronunciation, is this: in England, they speak from the mouth; in Italy, from the chest.

These are the radical differences and difficulties which our readers must strive to overcome.

PRONUNCIATION OF VOWELS AND CONSONANTS.

We now proceed to explain Italian pronunciation in a method of recent adoption by some ingenious teachers of Italy, by which all the combinations of the vowels and consonants, and consequently all the ingredients and component parts of the language, will pass under the eye of the reader. Let him learn from the very beginning of his labours to pronounce each syllable of the following words and tables, and he will soon acquire a correct method of pronunciation.

The Italian language has five vowels, representing seven sounds:—

I. *a*, invariably sounded like the English interjection *ah*.

II. *i*, invariably sounded like *ee* in *see*.

III. *u*, invariably sounded like *oo* in *too*.

IV. 1. *e*, invariably sounded like *ay* in *say*, but with a slight opening of the mouth only, and with an elevated and clear tone. It is called, on that account, the close sound of the vowel.

2. *e*, invariably sounded something like *e* in *let*, *set*, and the first *e* in *every*, but with a wide opening of the mouth, and with a deep sound. It is called, on that account, the open sound of the vowel.

V. 1. *o*, invariably sounded with a medium sound between *o* and *oo*, which has no equivalent in the English language, but which may be easily caught by the ear from hearing an educated Roman or Tuscan speak. Perhaps an approximation is the *o* in *bone*, *hole*, and *note*, but with a slight opening of the mouth only, and with an elevated and clear tone. It is called, on that account, the close sound of the vowel.

2. *o*, invariably sounded something like *o* in *lord* and *orange*, but with a wide opening of the mouth, and with a deep sound. It is called, on that account, the open sound of the vowel.

The first sound of *e* and the first of *o* occur in the majority of syllables, and may be called the ruling sounds of those two vowels. No distinguishing sign is used in Italian to mark the two *e's* or two *o's*. Englishmen must have some mark to indicate when *e* and *o* are to be sounded with their second or open sounds. We shall, in these cases, place on *e* and *o* this sign ^, *ê*, *ô*. Pronunciation of what, for the sake of distinction, we shall denominate the *circumflexed* sounds of *e* and *o* is not uniform throughout Italy; but as the pronunciation of Rome and Florence is the standard, all departures from it may be reckoned by our students as provincialisms, which ought to be carefully avoided.

The Italian consonants, seventeen in number, are divided into mutes and semi-vowels. Mutes are those that require a vowel after them to render them pronounceable. Semi-vowels are those which require a vowel before them to make them pronounceable.

Let us first enumerate the mutes, and show by tables their combinations with vowels in Italian words. There are ten mutes.

I. *b*, named in the alphabet, *bee*.

II. *c*, named in the alphabet *chee*, and sounded like *ch* in *church* before the vowels *e* and *i*. Before all other vowels it is sounded like *k* in English.

III. *d*, named in the alphabet *dee*.

IV. *g*, named in the alphabet *jee*, and sounded like *g* in *ginger* before the vowels *e* and *i* only. Before all other vowels it is sounded like *g* in *gang*, *go*, and *gull*.

V. *j*, named in the alphabet *i* (*ee*) *lungo* or *jota* (*i consonante*), and sounded like *y* in *yes* only at the commencement of a word or syllable and before a vowel. At the termination of a word it is no longer a consonant, but must be sounded like a prolonged or lengthened *ee*.

VI *p*, named in the alphabet *pee*.

VII. *q*, named in the alphabet *koo*. It is an auxiliary letter, only used before *u* with the sound of *k*.

VIII. *t*, named in the alphabet *tee*.

IX. *v*, named in the alphabet *vee*.

X. *z*, named in the alphabet *tsaita*, sounded like *tz* in *Switzerland*, or like *dz* in *adze*. These sounds vary in different parts of Italy. After *l*, *n*, and *r*, it is generally pronounced like *tz* in *Switzerland*. The same sharp sound occurs in words derived from Latin, and ending in *zia*, *zio*, *zione*, etc.

We shall mark each word in the following pronouncing tables, and indeed each word given as an example or illustration, with an accent, which, being merely arbitrary, used for the occasion to facilitate the progress of the English learner, and not used in Italian printing, we denominate the *accent of tone*. In every Italian word composed of more than one syllable, there is always one syllable on which, when we pronounce it, the voice ought to pause with a marked elevation of tone. The accent of tone is strongly marked in Italian; and on the marked use of this accent in a great measure depends the harmony of the language. We shall mark this accent by the *acute* sign (′) from right to left. It is true that this sign is sometimes printed in Italian words, but in a very few instances only.

FIRST PRONOUNCING TABLE,

showing the combination of vowels with mute consonants in natural order.

Italian.	*Pronounced.*	*English.*
Bado	báh-do	I take care.
Bevo	bai-vo	I drink.
Bice	bee-tchai	Beatrice, a woman's name.

The reader must not forget our previous observation that *c* before *e* and *i* is sounded like *ch* in the English word *church.*

Italian.	*Pronounced.*	*English.*
Boce (for *voce*)	bo-tchai	Voice, word.

The acute accent over *o* marks not only the accent of tone, but also the first sound of *o* as stated before.

Italian.	*Pronounced.*	*English.*
Buco	boo-ko	Hole.
Ebano	é-bah-no	Ebony.

Once for all, we must refer our readers to the opening explanation, where we stated that there is no English equivalent to the second, open or circumflexed sound of the *e*, as in the first syllable of *ebano*. In all cases of the *e* circumflexed, the reader must studiously avoid the English sound of *e*, which would only create the greatest confusion.

Italian.	*Pronounced.*	*English.*
Abete	ah-bê-tai	Fir-tree.
Abile	ah-bee-lai	Able.
Obolo (Latin, *obolus*)	ó-bo-lo	Farthing.

The reader must bear in mind that this is the second or less frequent sound of *o*, something like the English *o* in the words *orange* and *lord*, but with a wider opening of the mouth and a deeper sound. We give it the circumflex mark, because it is the less common sound. Wherever it occurs in our lessons, it will invariably denote, as in the case of the circumflexed *e*, the accent of tone as well as the peculiar sound of the *o*.

Italian.	*Pronounced.*	*English.*
Abuso	ah-bóo-zo	Abuse.
Babbo (Tuscan)	báhb-bo	Papa.

It is a fundamental rule of Italian pronunciation that double consonants must be uttered and *vibrated* distinctly. This is essentially necessary, not only as it augments the beauty and marks the orthography of words, but as it frequently distinguishes words of totally different meaning, but differing only in spelling by the single consonant instead of the double one; as, for example, *caro*, dear, and *carro*, a car; as we shall have occasion later more fully to illustrate. Where a vowel precedes a consonant, a particular stress must be laid on that vowel, and its sound must be shortened.

Italian.	*Pronounced.*	*English.*
Bebbe (for *bevve*)	béb-bai	He drank.

The English *e*, whenever it is sounded as in the word *get*, corresponds to the shortened sound of the first sound of *e* (*ai*).

Italian.	*Pronounced.*	*English.*
Gibbi (for *gobbi*)	jib'-bee	Hunchbacks.

The reader must not forget our previous observation that *g* before *e* and *i* is sounded as in the English word *ginger*.

Italian.	*Pronounced.*	*English.*
Gobbo	gób-bo	A hunchback.
Dubbi	dóob-bee	Doubts.
Cado	káh-do	I fall.
Cecino	tchai-tchée-no	A wild swan.
Cito	tchée-to	Quickly.
Coda	kó-dah	Tail.
Cute	kóo-tai	Skin.
Ducato	doo-káh-to	Dukedom, ducat.
Ricevo	ree-tchai-vo	I receive.
Incido	in-tchee-do	I cut.
Ancona	ahn-kó-nah	Ancona.
Lacuna	lah-kóo-nah	Pool, swamp.
Bacco	báhk-ko	Bacchus.
Becco	bêk-ko	Beak.
Picca	pík-kah	Spear.
Bocca	bók-kah	Mouth.
Succo	sóok-ko	Juice.
Dado	dáh-do	Die [for gaming].
Devo	dái-vo	I ought, I must.
Dito	dée-to	Finger.
Dopo	dô-po	After, afterwards.
Duce	dóo-tchai	General.
Edace	ai-dah-tchai	Gluttonous.
Adele	ah-dê-lai	Adeline, a woman's name.
Adiro	ah-dee-ro	I provoke to anger.
Adoro	ah-do-ro	I adore.
Aduno	ah-doo-no	I unite, I assemble others.
Adda	áhd-dah	The river Adda.
Edda	êd-dah	The Edda of Scandinavian literature.
Iddio	Id-dée-o	God.
Adduco	ahd-dóo-ko	I lead to.
Gaza	Gáh-dzah	Gaza in Palestine.
Gelo	jê-to	Jess (in falconry).
Gita	jée-tah	A walk, trip.
Godo	gó-do	I rejoice.
Gufo	góo-fo	A horned owl.
Legame	lai-gah-mai	A tie, ligament.
Angelo	áhn-jai-lo	Angel.
Angina	ahn-jée-nah	Inflammation of the throat.
Vigore	vee-gó-rai	Vigour.
Arguto	ahr-góo-to	Ingenious, witty.
Paggi	páhd-jee	Pages (attendants).

The pronunciation of *gg* depends on the vowel that follows the latter *g*. If that vowel is *e* or *i*, the *gg's* are pronounced somewhat as if the first *g* had merely the sound of *d;* and the second *g*, which goes to the next syllable, like the English *j* in *jay*, only the voice must not pause too long on the *d* of the syllable where the first *g* occurs; the stress must be laid on it, and the voice must glide as quickly as possible to the pronunciation of the second *g*, which must be very soft. In this way there will be effected a more equal distribution of the sound *j* between the two syllables, which will produce the correct sound of the *gg*.

We would especially desire our pupil readers to repeat aloud every word successively until they have made themselves quite familiar with their various and distinct sounds.

Italian.	*Pronounced.*	*English.*
Veggo	vég-go	I see.

When the *gg's* are followed by *a*, *o*, or *u*, they are pronounced in each syllable like the English *g* in *get*.

Italian.	*Pronounced.*	*English.*
Oggi	ód-jee	To-day.
Fuggi	fóod-jee	Fly!
Pace	páh-tchai	Peace.
Pece	pái-tchai	Pitch.
Pino	pée-no	Pine.
Poco	pó-ko	Little.
Pute	póo-tai	It has a bad smell.
Riparo	ree-pah-ro	I repair.
Impèro	im-pé-ro	Empire.
Tapino	tah-pée-no	Wretched.
Sapone	sah-pó-nai	Soap.
Impune	im-póo-nai	Unpunished.
Pappa	páhp-pah	Pap for children.
Peppe	pêp-pai	Joseph, Joe.
Pippo	píp-po	Philip, Phil.
Coppa	kóp-pah	The occiput, goblet.
Zuppa	tzóop-pah	Soup.
Tabe	táh-bai	Consumption.
Teco	tái-ko	With thee.
Tipo	tée-po	Type (a model).
Topo	tô-po	Mouse.
Tubo	tóo-bo	Tube.
Altare	ahl-táh-rai	Altar.
Altero	ahl-tê-ro	Haughty.
Altire	ahl-tée-rai	To mount.
Alloro	ahl-lô-ro	Laurel.
Altura	ahl-tóo-rah	Height.
Atto	áht-to	Act, action.
Getto	jêt-to	Cast, throw.
Fitto	fít-to	Rent, split.
Cotto	kót-to	Cooked.
Tutto	tóot-to	All, quite.
Vano	váh-no	Vain.
Vero	vái-ro	True.
Vino	vée-no	Wine.
Voto	vó-to	Vow.
Avuto	ah-vóo-to	Had.
Bavaro	báh-vah-ro	Bavarian.
Severo	sai-vê-ro	Severe.
Divino	dee-vee-no	Divine.
Lavoro	lah-vó-ro	Labour.
Dovuto	do-voo-to	Debt, duty.
Davvi	dáhv-vee	He gives you.
Evvi	év-vee	Is there?
Udivvi	oo-div-vee	He heard you.
Dovvi	dôv-vee	I give you.
Fuvvi	fóov-vee	Was there?
Zara	tzah-rah	Zara, a town.
Zero	dzê-ro	Cipher.
Zitella	tzee-tel-lah	Spinster.
Zona	dzó-nah	Zone, girdle.
Zugo	tzóo-go	Omelet.

There is very little difference between the pronunciation of the single *z* and *zz*. The *zz*, as well as *z*, may have the sound of *tz* in the word *Switzer*, or *dz* in the word *adze*. According to modern orthography, the *z* is generally doubled between two single vowels in the middle of a word, but not after a consonant, and not before diphthongs the first vowel of which is *i;* as, for examples, *ia*, *ie*, *io*, where it must remain single, and has the hard sound.

Italian.	*Pronounced.*	*English.*
Pezzo	pê-tzo	Piece.
Pozzo	pó-tzo	A well.
Puzzo	póo-tzo	A bad smell.
Pagato	pah-gáh-to	Paid.
Ithaca	ée-tah-kah	Ithaca in Greece.
Agape	áh-gah-pai	Agape, or Christian love-feast.
Ricamo	ree-káh-mo	Embroidery.
Vegeto	vê-jai-to	Stout, robust.
Aceto	ah-tchái-to	Vinegar.
Gaeta	gah-ái-tah	Town in Naples.
Cedete	tchai-dái-tai	Yield!
Cadice	káh-dee-tchai	Cadiz.
Egida	ai-jée-dah	Ægis.
Tacito	táh-tchee-to	Tacitus.
Vagito	vah-jee-to	An infant's cry.
Rigore	ree-gó-rai	Rigour.
Epocha	ê-po-ka	Epoch.
Pagoda	pah-gô-dah	Pagoda.
Jacopo	jáh-ko-po	Jacob.
Aguto	ah-góo-to	Nail.
Acuto	ah-kóo-to	Acute, ingenious.
Cicuta	tchee-cóo-tah	Water hemlock.
Ceduto	tchai-dóo-to	Yielded.
Apogeo	ah-po-jê-o	Apogee.
Educato	ai-doo-kah-to	Educated.
Vocativo	vo-kah-tee-vo	Vocative.
Zebedeo	tzai-bai-dê-o	Zebedee.
Tucidide	too-tchée-dee-dai	Thucydides.
Abituato	ah-bee-too-áh-to	Habituated.
Zodiaco	dzo-dée-ah-ko	Zodiac.
Agarico	ah-gáh-ree-ko	Fungus growing on larches.
Idiota	ee-dee-ó-tah	An idiot.
Abigeato	ah-bee-jai-áh-to	Stealing of cattle.
Vegetativo	vai-jai-tah-tée-vo	Growing.
Decapitato	dai-kah-pee-táh-to	Decapitated.
Decaduto	dai-kah-dóo-to	Decayed.
Agitato	ah-jee-táh-to	Agitated.
Epicuro	ai-pee-kóo-ro	Epicurus.
Pedagogia	pai-dah-go-jée-ah	Education and government of children.

THE SEMI-VOWELS.

There are six semi-vowels in the Italian language, so called because in their utterance a vowel must be placed before the consonant. They are not pronounced in one syllable only, as in the case of the mutes, but require the utterance of two syllables, which syllables are substantially the same, though in an inverse order. The semi-vowels are—

1. *F f*, named in the alphabet *effe* (pronounced in the following manner—éf-fai).

2. *L l*, named in the alphabet *elle* (pronounced êl-lai). It has two sounds—one like the English consonant *l;* the second is a peculiar sound, of which we shall have occasion to speak in the pronouncing tables.

3. *M m*, named in the alphabet *emme* (pronounced ém-mai). To ensure perfect accuracy in the pronunciation, we may remark that when *m* is preceded by a vowel with which it forms one syllable, and a consonant being the next letter, it must be very softly sounded, and the voice must glide quickly to the next consonant, almost as if it formed part of the same syllable; for example, *ambizione*, ahm͡-bee-tzee-ó-nai, ambition; *empio*, ém͡-peeo, impious; *ombra*, ôm͡-brah, a shadow.

4. *N n*, named in the alphabet *enne* (pronounced én-nai). Generally speaking, this letter is pronounced just as in English; but the observation made on the *m* is equally applicable to *n*. In similar circumstances, the voice must glide quickly from the *n* to the succeeding consonant: for example, *andare*, ahn͡-dáh-rai, to go; *entrare*, en͡-tráh-rai, to enter; *onda*, ón͡-dah, a wave. After *g*, *n* has a peculiar sound, which we shall have occasion to explain in the pronouncing tables. Often *n* is pronounced like *m* before words commencing with the consonants *b*, *m*, and *p;* as, *gran bestia*, pronounced grahm͡ bê-steeah, a boorish, insolent fellow, great blockhead, etc.; *scolpire in marmo*, pronounced skol-pée-rai im͡ mahrr-mo, to chisel in marble; *con poca fatica*, pronounced kom͡ pô-kah fah-tée-kah, with little fatigue. This is certainly the finest pronunciation, because it is the genius of the Italian language, as in the classical tongues, particularly Greek, to soften the transition, or passing over, from one word to another, and often from one syllable to the other, by changes of consonants.

5. *R r*, named in the alphabet *erre* (pronounced ér-rai). *R*, when it is followed by a consonant, must be vibrated with a stronger emphasis than in English; and it is on the other hand very soft before a vowel; as, *carta*, pronounced káhrr-ta, paper, and soft in *cara*, pronounced káh-rah, dear.

6. *S s*, named in the alphabet *esse* (pronounced ês-sai). This consonant has considerable variations, and is one of the most difficult to pronounce throughout correctly, for even in Italy there are variations.

A strictly correct and irreproachable pronunciation of this consonant can only be acquired by closely marking its utterance in all its shades by Italians who speak purely. Speaking generally, there are two leading sounds. One is a sharp, hissing sound, as in the English words *sing*, *sieve;* the other is a much milder sound, as in the English words *cheese*, *ease*, *please*, etc.

ELOCUTION.—VI.

[Continued from Vol. V., p. 358.]

VIII.—CORRECT INFLECTIONS.

"INFLECTION" in elocution signifies an upward or downward "slide" of voice from the average, or level, of a sentence.

There are two simple "inflections" or "slides,"—the upward or "rising," and the downward or "falling." The former is usually marked by the acute accent [´]; the latter, by the grave accent [`].

The union of these two inflections on the same syllable is called the "circumflex," or wave. When the circumflex commences with the falling inflection, and ends with the rising, it is called the "rising circumflex," marked thus [ˇ]; when it begins with the rising, and ends with the falling, it is called the "falling circumflex," marked thus [ˆ].

When the tone of the voice has no upward or downward slide, but keeps comparatively level, it is called the "monotone," marked thus [–].

Examples.—Rising Inflection.

"Intensive," or high, upward slide, as in the tone of surprise :—

Há! Is it póssible?

In the usual tone of a question, that may be answered by *Yes* or *No* :—

Is it réally so?

"Moderate" rising inflection, as at the end of a clause which leaves the sense dependent on what follows it :—

If we are sincerely desirous of advancing in knówledge, we shall not be sparing of exertion.

The "slight" *rising inflection*—marked thus [ˇ], is used when the voice is suddenly and unexpectedly interrupted :—

When the visitor entered the rŏom — * * * *

The last-mentioned inflection may, for distinction's sake, be marked as above, to indicate the absence of any positive upward or downward slide, and, at the same time, to distinguish it from the intentional and prolonged level of the "monotone."

Falling Inflection.

"Intensive," or bold and low downward slide, as in the tone of anger and scorn :—

Dòwn, *ruthless insulter!*

The "full" falling inflection, as in the cadence at a period :—

All his efforts were in vain.

The "moderate" falling inflection, as at the end of a clause which forms complete sense —

Do not presume on weàlth; it may be swept from you in a moment.

The horses were hàrnessed; the carriages were driven up to the dòor; the party were sèated: and, in a few moments, the mansion was left to its former silence and solitude.

The "suspensive," or slight falling inflection, marked thus [ˆ], as in the members of a "series," or sequence of words and clauses, in the same syntactical connection :—

The fôrce, the sîze, the wêight of the ship, bore the schooner down below the waves.

The irresistible fôrce, the vast sîze, the prodigious wêight of the ship, rendered the destruction of the schooner inevitable.

The "suspensive" downward slide is marked as above to distinguish it from the deeper inflection at the end of a clause, or of a sentence.

TABLE OF CONTRASTED INFLECTIONS.

The Rising followed by the Falling.

Will you go, or stày?
Will you ride, or walk?
Did he travel for health, or for plèasure?
Does he pronounce correctly, or incorrectly?
Is it the rising, or the falling inflection?

The Falling followed by the Rising.

I would rather gò than stay.
I would rather walk than ride.
He travelled for health, not pleasure.
He pronounces correctly, not incorrectly.
It is the falling, not the rising inflection.

Examples of Circumflex.

Tone of Mockery.—I've caught you, then, at lâst!
Irony.—Couràgeous chief!—the first in flight from pain!
Punning.—And though heavy to wêigh, as a score of fat sheep,
He was not, by any means, heavy to slêep.

Example of Monotone.—Awe and Horror.

I could a tāle unfōld whose lightest wōrd
Would hārrow ūp thy sōul, frēeze thy young blōod,
Māke thy twō ēyes, like stārs, stārt from their sphēres,
Thy knōtted and combīned lōcks to pārt,
And ēach particular hāir to stānd on ēnd,
Like quills upon the frētful pòrcupine.

Rules on the Rising Inflection.

Rule 1.—The "intensive," or high rising inflection expresses *surprise* and *wonder*, as :—

Há! laugh'st thou, Lochiel, my vision to scórn?

Rule 2.—The "moderate" rising inflection takes place where the sense is incomplete, and depends on something which follows :—

As we cannot discern the shadow moving along the dial-plate, so we cannot always trace our progress in knowledge.

Note.—Words and phrases of address, as they are merely introductory expressions, take the "moderate rising inflection," as :—

Friends, I come not here to talk.
Sir, I deny that the assertion is correct.
Sóldiers, you fight for home and liberty!

Exception.—In emphatic and in lengthened phrases of address the falling inflection takes place, as :—

On! ye bràve, who rush to glory or the grave!
Sòldiers! if my *standard* falls, look for *the plume upon your king's helmet!* *

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* Shouting tone.

My friends, my fóllowers, and my children! the field, we have entered is one from which there is no retreat.

Gentlemen and knights—commoners and sòldiers, Edward the Fourth upon his throne will not profit by a victory more than you.

Rule 3.—The "suspensive," or slight rising inflection, occurs when expression is suddenly broken off, as in the following passage in dialogue :—

Poet. The poisoning dăme—
Friend. You mĕan—
P. I don't.
F. You do.

Note.—This inflection, prolonged, is used in the appropriate tone of reading verse, or of poetic prose, when not emphatic, instead of a distinct rising or falling inflection, which would have the ordinary effect of prosaic utterance, or would divest the expression of all its beauty.

Examples.

Here wăters, wŏods, and winds in concert join,
And flŏcks, wŏods, strĕams around, repose and peace impart.
The wild brook babbling down the mountain's side ;
The lowing hĕrd ; the sheepfold's simple bĕll ;
The pipe of early shepherd, dim descried
In the lone vălley ; echoing far and wide,
The clamorous horn, along the cliffs above ;
The hollow murmur of the ocean tíde ;
The hum of bĕes, the linnet's lay of love,*
And the full choir that wakes the universal grove.

White houses peep through the trĕes ; cattle stánd cooling in the pŏol ; the casement of the farm-house is covered with jessamine and hóneysuckle ;* the stately greenhouse exhales the perfume of summer climates.

Rule 4.—A question which may be answered by *Yes* or *No* usually ends with the rising inflection, as :—

Do you see yon clóud ?

Exception.—Emphasis, as in the tone of impatience, of extreme earnestness, or of remonstrance, may, in such cases as the above, take the falling inflection, as :—

Can you be so infatuated as to pursue a course which you know will end in your rùin ?

Will you blindly rush on destrùction ?

Would you say so, if the case were your *òwn* ?

Rule 5.—The penultimate, or last inflection but one,* is, in most sentences, a rising slide, by which the voice prepares for an easy and natural descent at the cádence, as :—

The rocks crùmble, the trees fall, the leaves fade, and the grass withers.

Exception.—Emphasis may sometimes make the penultimate inflection fall, instead of rising ; as the abruptness of that slide gives a more forcible effect :—

They have rushed through like a hùrricane ; like an army of lòcusts, they have devoured the èarth ; the war has fallen like a waterspòut, and deluged the land with blood.

Rules on the Falling Inflection.

Rule 1.—The "intensive, downward slide," or "low," falling inflection, occurs in the emphasis of *vehement emotion*, as :—

'ON! 'ON to the *just* and the *glorious strife!*

Rule 2.—The "full" falling inflection usually takes place at the cadence, or close, of a sentence, as :—

No life is pleasing to God, but that which is useful to mankind.

Exception.—When the meaning expressed at the close of one sentence is modified by the sense of the next, the voice may rise, instead of falling, as :—

We are not here to discuss this question. We are come to àct upon it.

Gentlemen may cry "peace, péace!" But there is no peace.

Rule 3.—The "moderate" falling inflection occurs at the end of a clause which forms complete sense, independently of what follows it, as :—

Law and order are forgòtten : violence and rapine are abròad : the golden cords of society are loosed.

Exception.—Plaintive expression, and poetic style, whether in the form of verse or of prose, take the "slight" *rising* inflection, in its prolonged form :—

Cold o'er his limbs the listless languor grew ;
Paleness came o'er his eye of placid blŭe ;
Pale mourned the lily where the rose had died ;
And timid, trembling, came he to my side.

The oaks of the mountains făll ; the mountains themselves decay with yĕars ; the ocean shrinks and grows agăin ; the moon herself is lost in héaven ;* but thou art for ever the sàme, rejoicing in the brightness of thy course.

Rule 4.—The "suspensive," or slight falling inflection, takes place in every member but one of the "series," or successive words and clauses, connected by the same conjunction, expressed or understood.

Note 1.—A succession of *words* is termed a "simple series ;" a succession of *clauses* a "compound series." A succession of words which leaves the sense *incomplete* is termed a "commencing series ;" that which leaves complete sense, a "concluding series." A commencing series is read with the "suspensive,' or slight falling inflection, on every member but the last ; a concluding series, with the "suspensive" slide on every member, except the penultimate, or last but one.

Simple commencing series :—

The âir, the êarth, the wáter, teem with delighted existence.

Simple concluding series :—

Delighted existence teems in the âir, the éarth,† and the wáter.‡

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* The penultimate inflection of a sentence, or a stanza, usually rises, so as to prepare for an easy cadence.

* Rising slide, for contrast to the following clause.

† "Penultimate" rising inflection, preparatory to the cadence, or closing fall of voice, at the end of a sentence.

‡ "Full" falling inflection, for the cadence of a sentence.

Compound commencing series:—

The fluid expanse of the âir, the surface of the solid êarth, the liquid element of water, teem with delighted existence.

Compound concluding series:—

Delighted existence teems in the fluid expanse of the âir, the surface of the solid earth,* and the liquid element of wàter.†

Exception 1.—Emphatic, abrupt, and disconnected series may have the "moderate" or the "bold" downward slide on *every* member, according to the intensity of expression, as:—

His succèss, his fàme, his life were all at stake.

The roaring of the wind, the rushing of the wàter, the darkness of the night, all conspired to overwhelm his guilty spirit with dread.

Eloquence is àction, nòble, sublime, gòdlike action.

The shore, which, but a few moments before, lay so lovely in its calm serenity, gilded with the beams of a level sun, now resounded with the roar of cànnon, the shouts of bàttle, the clash of àrms, the curses of hàtred, the shrieks of àgony.

Exception 2.—Light and humorous description gives the "moderate" upward slide to all the members of a series, as:—

Her bóoks, her músic, her pápers, her clóthes, were all lying about the room, in "most admired disorder."

Exception 3.—The language of pathos (pity), tenderness, and beauty—whether in verse or prose—takes the "suspensive," or slight rising inflection, except in the last member of the "commencing" and the last but one of the "concluding series," which have the usual "moderate" rising inflection, as:—

No mournful flowers, by weeping fondness laid,
No pink, no rose, drooped, on his breast displayed.
There wrapt in grătitude, and jŏy, and lóve,
The man of God will pass in Sabbath noon.

There (in the grave), vile insects consume the hand of the ărtist, the brain of the philŏsopher, the eye which sparkled with celestial fire, and the lip from which flowed irresistible eloquence.

Note 2.—All series, except the plaintive—as by their form of numbers and repetition, they partake of the nature of "climax," or increase of signification—should be read with a growing intensity of voice, and a more prominent inflection on every member, as:—

The splendour of the firmament, the verdure of the èarth, the varied colours of the flowers which fill the air with their fràgrance, and the music of those artless voices which mingle on every trèe; all conspire to captivate our hearts, and to swell them with the most rapturous delight.

This remark applies sometimes even to the rising inflection, but with peculiar force to cases in which the language is obviously meant to swell progressively in effect, from word to word, or from clause to clause, and which end with a downward slide on every member, as in the following instance:—

I tell you, though *yoŭ*, though all the WÒRLD, though an angel from H'EAVEN, should declare the truth of it, I could not believe it.

Rule 5.—All questions which cannot be answered by *Yes* or *No* end with the falling inflection, as:—

When will you cease to trifle?
Where can his equal be fòund?
Who has the hardihood to maintain such an assèrtion?
Why come not on these victors pròud?
What was the object of his ambition?
How can such a purpose be accòmplished?

Exception.—The tone of real or affected surprise throws such questions, when repeated, into the form of the rising inflection, as:—

How can such a purpose be accómplished!
To the diligent *all* things are possible.

Both Inflections, the Rising and the Falling, in Connection.

Rule 1.—When negation is opposed to affirmation, the former has the rising, the latter the falling inflection, in whatever order they occur, and whether in the same or in different sentences, as:—

He did not call mé but yòu.
He was esteemed not for wealth, but for wisdom.
Study not for amusement, but for impròvement.
He called yòu, not me.
He was esteemed for wisdom, not for wealth
Study for improvement, not for amusement.

This proposal is not a mere idle compliment. It proceeds from the sincerest and deepest feelings of our hearts.

Howard visited all Europe, not to survey the sumptuousness of palaces, or the stateliness of temples; not to make accurate measurements of the remains of ancient grándeur; not to form a scale of the curiosities of modern árt; not to collect medals or collate manuscripts: but to dive into the depths of dùngeons; to plunge into the infection of hòspitals; to survey the mansions of sorrow and pàin; to take the gauge and dimensions of misery, depression, and contèmpt; to remember the forgotten, to attend to the neglècted, to visit the forsaken, and to compare and collate the distresses of all men in all countries.

Note.—A similar principle applies to the reading of concessions and of unequal antitheses or contrasts. In the latter, the less important member has the rising, and the preponderant one the falling inflection, in whatever part of a sentence they occur, and even in separate sentences, as:—

Science may raise you to éminence. But virtue alone can guide you to hàppiness.

I rather choose
To wrong the dèad, to wrong myself and yòu,
Than I will wrong such honourable men

Exception.—When negation is emphatic or preponderant, it takes the falling inflection, as:—

He may yield to persuásion, but he will never submit to fòrce.

We are troubled on every side, yet not distrèssed; perpléxed, but not in despàir; pérsecuted, but not forsàken; cast down, but not destròyed.

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* "Penultimate" rising inflection, preparatory to the cadence, or closing fall of voice, at the end of a sentence.

† "Full" falling inflection, for the cadence of a sentènce.

Rule 2.—In question and answer, the falling inflection ends as far below the average level of the sentence as the rising ends above it. In this way, a certain exact correspondence of sound to sound, in the inflections, is produced, which gives to the full downward slide of the answer a decisive and satisfactory intonation, as a reply to the rising slide of the question, as :—

Are they Hébrews?—So am'I. Are they 'Israelites?—So am'I.

What would content you, in a political leader?—Tálent? Nò!—'Enterprise? Nò!—Courage? Nò!—Reputátion? Nò!—* Virtue? Nò!—The man whom you would select should possess not óne, but àll of these.

Rule 3.—When a question consists of two contrasted parts, connected in syntax by the conjunction *or*, used in a disjunctive sense, the former has the rising, and the latter the falling inflection, as :—

Does he mean yoú, or mè?
Is this book yóurs, or mìne?
Did you see hím, or his bròther?
Are the people vírtuous, or vìcious; intélligent, or ìgnorant; áffluent, or ìndigent?

Note.—When *or* is used *conjunctively*, the second inflection does not fall, but rises higher than the first, as :—

Would the influence of the Bible—even if it were not the record of a divine revelation—be to render princes more tyrannical, or subjects more ungóvernable; the rich more insolent, or the poor more disorderly; would it make worse párents or chíldren—husbands or wives—másters or sérvants—friends or néighbours? Or† would it not make men more vírtuous,† and consequently more hàppy, in èvery situation?

Rule on the Circumflex, or Wave.

The circumflex, or wave, applies to all expressions used in a peculiar sense, or with a double meaning, and to the tones of mockery, sarcasm, and irony, as :—

You may avoid a quarrel with an if. . . . Your if is the only peacemaker: much virtue in an if.

From the very first night—and to say it I am bold—
I've been so very hôt, that I'm sure I've caught cóld!

Go hang a cálfskin on these recreant limbs!
What a béautiful piece of work you have made by your carelessness!
The weights had never been accused of light conduct.

Rule on the Monotone.

The tones of grand and sublime description, profound reverence or awe, of amazement and horror, are marked by the monotone, or perfect level of voice.

Note.—A monotone is always on a lower pitch than the preceding part of a sentence; and to give the greater effect to its deep solemn note—which resembles the tolling of a heavy bell—it sometimes destroys all comma pauses, and keeps up one continuous stream of overflowing sound, as :—

His form had not yet lost
All her original brightness, nor appeared
Less than archangel ruined, and the excess
Of glory obscured. Ās when the sūn, nēw-risen,
Lōoks thrōugh the horizōntal misty āir,
Shorn of his beams, ōr from behind the mōon,
In dim eclipse, disāstrous twilight shēds
On hālf the nātions, and with fear of change
Perplexes monarchs.

And I sāw a grēat white thrōne and Him that sāt on it, from whōse fāce the hēavens and the ēarth flēd awāy; and there was fōund nō plāce for them.

Upon my secūre hōur thy ūncle stole,
With jūice of cūrsed hēbenon in a vial,
And in the pōrches of mine ēars did pōur
The lēperous distilment; whose ēffect
Hōlds such an ēnmity with blōod of mān,
That swift as quicksilver it cōurses thrōugh
The natural gātes and ālleys of the bōdy,
And, with a sūdden vigour, it doth pōsset
And cūrd, like ēager drōppings into milk,
The thin and whōlesome blōod; sō did it mine;
And a most īnstant tētter bārked abōut,
Most lāzar-like, with vile and lōathsome crūst,
All my smōoth bòdy.

Rule on "Harmonic" Inflections.

"Harmonic" inflections—or those which, in emphatic phrases, are intended to prevent the frequent occurrence of emphasis in the same phrase from becoming monotonous to the ear—are applied in clauses of which every word is emphatic, and are marked by a distinct and separate inflection, as :—

He has been guilty of one of the most *shámeful àcts* || that *éver degraded* | the N'ATURE || or the NA'ME || of M'AN.

Note.—In such cases the inflections usually alternate, in order to give the more vivid and pungent force to vehement emphasis.

Rule on Repeated Words, Phrases, and Sentences.

Words, phrases, and sentences which are repeated for effect, rise higher, or fall lower in inflection, besides increasing in force, at every repetition.

From these walls a spirit shall go forth, that shall survive when this edifice shall be, "like an unsubstantial pageant, faded." It shall go fórth, exulting in, but not abusing, its strength. *It shall go fórth*, remembering, in the days of its prosperity, the pledges it gave in the time of its depression. IT SHALL GO FO'RTH, uniting a disposition to correct abuses, to redress grievances. IT SHALL GO FO'RTH, uniting the disposition to improve, with the resolution to maintain and defend, by that spirit of unbought affection, which is the chief defence of nations.

What was it, fellow citizens, which gave to Lafayette his spotless fame?—*The love of liberty.* What has consecrated his memory in the hearts of good men?—THE LOVE OF LIBERTY. What nerved his youthful arm with strength, and inspired him in the morning of his days with sagacity and counsel?—THE LIVING LOVE OF LI'BERTY. To what did he sacrifice power, and rank, and country, and freedom itself?—*TO THE LOVE OF LIBERTY PROTECTED BY LA'W.*

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* In successive questions, the rising inflection becomes higher at every stage, unless the last has, as in the above example, the falling inflection of consummating emphasis.

† The last *or* is used disjunctively, and forms an example to the Rule, and not to the Note.

GERMAN.—XXXI.

[Continued from Vol. V., p. 380.]

THE OLD OR STRONG DECLENSION.

TERMINATIONS.

	Singular.	*Plural.*
Nom.	—.	-e.
Gen.	-es *or* -s.	-e.
Dat.	-e (*or like Nominative*).	-en.
Acc.	—.	-e.

In the genitive singular the e is frequently omitted before s, when the elision does not cause an unpleasant sound, as:—Des Königs, of the king; des Monats, of the month; des Jahrs, of the year. Also, the -e of the dative is often dropped, as:—Dem König, to the king; and it is never used when a preposition stands before the substantive without an article, pronoun, or adjective preceding, as:—Mit Beifall, with approbation; mit Sturm, by storm; mit Fleiß, on purpose; von Silber, of silver.

EXAMPLES.

	Singular.	*Plural.*
N.	Der Berg, the mountain.	Die Berge, the mountains.
G.	Des Berges, of the mountain.	Der Berge, of the mountains.
D.	Dem Berge, to the mountain.	Den Bergen, to the mountains.
A.	Den Berg, the mountain.	Die Berge, the mountains.

Some nouns of this declension take the letter r after e in all cases of the plural, and assume the Umlaut, if the radical vowel be capable of it.

EXAMPLES.

	Singular.	*Plural.*
N.	Das Dorf, the village.	Die Dörfer, the villages.
G.	Des Dorfes, of the village.	Der Dörfer, of the villages.
D.	Dem Dorfe, to the village.	Den Dörfern, to the villages.
A.	Das Dorf, the village.	Die Dörfer, the villages.
N.	Das Lied, the song.	Die Lieder, the songs.
G.	Des Liedes, of the song.	Der Lieder, of the songs.
D.	Dem Liede, to the song.	Den Liedern, to the songs.
A.	Das Lied, the song.	Die Lieder, the songs.

The nouns of this form (e + r) in the plural, among which are all substantives ending in -thum (as, der Reichthum, riches), are, for the most part, neuters, as:—

Aas, carrion.
Amt, office.
Bad, bath.
Band, ribbon.
Bild, picture.
Blatt, leaf.
Brett, board.
Buch, book.
Dach, roof.
Ding, thing (little).
Dorf, village.
Ei, egg.
Fach, compartment.
Faß, vat, tub.
Feld, field.
Geld, money.
Gemach, apartment.
Gemüth, mind.
Geſchlecht, species.
Geſicht, face.
Geſpenſt, spectre.
Gewand garment.
Glas, glass.
Glied, member.
Grab, grave.
Gras, grass.
Gut, good, estate.
Haupt, head.
Haus, house.
Holz, wood.
Horn, horn.
Huhn, fowl, hen.
Kalb, calf.
Kind, child.
Kleid, dress.
Korn, grain.
Kraut, herb.
Lamm, lamb.
Land, land.
Licht, light.
Lied, song.
Loch, hole.
Mahl, meal.
Maul, mouth.
Neſt, nest.
Pfand, pledge.
Rad, wheel.
Reis, twig.
Rind, cattle.
Schild, sign-board.
Schloß, castle.
Schwert, sword.
Thal, valley.
Tuch, cloth, shawl.
Volk, people.
Wamms, doublet.
Weib, woman.
Wort, word (in a dictionary).

The following nouns of this form are masculine:—

Böſewicht, villain.
Dorn, thorn.
Geiſt, spirit.
Gott, God.
Leib, body.
Mann, man.
Mund, mouth.
Ort, place.
Rand, margin.
Strauß, nosegay.
Vormund, guardian.
Wald, forest.
Wurm, worm.

Most nouns of the old declension whose radical vowel is a, o, u, or au, assume in the plural the Umlaut. Thus, Hand, Sohn, Buch, Haus, make their plurals as follows:—

EXAMPLES.

	Feminine.	*Masculine.*
N.	Die Hände, the hands.	Die Söhne, the sons.
G.	Der Hände, of the hands.	Der Söhne, of the sons.
D	Den Händen, to the hands.	Den Söhnen, to the sons.
A.	Die Hände, the hands.	Die Söhne, the sons.

	Neuter.	*Neuter.*
N.	Die Bücher, the books.	Die Häuser, the houses.
G.	Der Bücher, of the books.	Der Häuser, of the houses.
D.	Den Büchern, to the books.	Den Häusern, to the houses.
A.	Die Bücher, the books.	Die Häuser, the houses.

The words in which the Umlaut thus occurs are, chiefly—(1) primitive nouns of the masculine gender; (2) feminines which have their plural in -e, as also Mutter and Tochter; (3) neuter primitives having their plural in -er; (4), and lastly, nouns adding the diminutive terminations -chen and -lein

Nouns ending in -el, -en, -er, -chen, and -lein, reject the vowel e of inflection in all cases, both singular and plural; so that those in -el and -er merely affix s to the genitive singular and n to the dative plural, while those in -en, -chen, and -lein assume nothing beyond the s in the genitive singular.

EXAMPLES.

	Singular.	*Plural.*
N.	Der Vogel, the bird.	Die Vögel, the birds.
G.	Des Vogels, of the bird.	Der Vögel, of the birds.
D.	Dem Vogel, to the bird.	Den Vögeln, to the birds.
A.	Den Vogel, the bird.	Die Vögel, the birds.
N.	Der Degen, the sword.	Die Degen, the swords.
G.	Des Degens, of the sword.	Der Degen, of the swords.
D.	Dem Degen, to the sword.	Den Degen, to the swords.
A.	Den Degen, the sword.	Die Degen, the swords.
N.	Der Bürger, the citizen.	Die Bürger, the citizens.
G.	Des Bürgers, of the citizen.	Der Bürger, of the citizens.
D.	Dem Bürger, to the citizen.	Den Bürgern, to the citizens
A.	Den Bürger, the citizen.	Die Bürger, the citizens.
N.	Das Büchlein, the little book.	Die Büchlein, the little books.
G.	Des Büchleins, of the little book.	Der Büchlein, of the little books.
D.	Dem Büchlein, to the little book.	Den Büchlein, to the little books.
A.	Das Büchlein, the little book.	Die Büchlein, the little books.
N.	Das Söhnchen, the little son.	Die Söhnchen, the little sons.
G.	Des Söhnchens, of the little son.	Der Söhnchen, of the little sons.
D.	Dem Söhnchen, to the little son.	Den Söhnchen, to the little sons.
A.	Das Söhnchen, the little son.	Die Söhnchen, the little sons.

Some *feminine* nouns are in the plural varied according to this declension, especially those ending in the suffix -niß.

EXAMPLES.

	Singular.	*Plural.*
N.	Die Maus, the mouse.	Die Mäuſe, the mice.
G.	Der Maus, of the mouse.	Der Mäuſe, of the mice.
D.	Der Maus, to the mouse.	Den Mäuſen, to the mice.
A.	Die Maus, the mouse.	Die Mäuſe, the mice.
N.	Die Kenntniß, the knowledge.	Die Kenntniſſe.
G.	Der Kenntniß, of the knowledge.	Der Kenntniſſe.
D.	Der Kenntniß, to the knowledge.	Den Kenntniſſen.
A.	Die Kenntniß, the knowledge.	Die Kenntniſſe.

To this class belong the nouns in the following list:—

Angſt, anguish.
Armbruſt, cross-bow.
Ausflucht, evasion.
Art, axe.
Bank, bench.
Braut, bride.
Bruſt, breast.
Fauſt, fist.
Frucht, fruit.
Gans, goose.
Geſchwulſt, swelling.
Gruft, tomb.
Hand, hand.
Haut, skin.
Kluft, gulf.
Kraft, force.
Kuh, cow.
Kunſt, art.
Laus, louse.
Luft, air.
Luſt, delight.
Macht, power.
Magd, maid-servant.
Nacht, night.
Naht, seam.
Noth, distress.
Nuß, nut.
Sau, sow.
Schnur, string.
Stadt, city.
Wand, wall.
Wulſt, pad.
Wurſt, sausage.
Zunft, guild.
Zuſammenkunft, meeting.

THE NEW OR WEAK DECLENSION.

TERMINATIONS.

	Singular.	*Plural.*
Nom.	—.	-en *or* -n.
Gen.	-en *or* -n	-en *or* -n.
Dat.	-en *or* -n.	-en *or* -n.
Acc.	-en *or* -n.	-en *or* -n.

NOTE.—When the nominative singular ends in -e, -el, or -r, the rest of the cases in the singular and all the cases in the plural take n only.

EXAMPLES.

	Singular.	*Plural.*
N.	Der Graf, the count.	Die Grafen, the counts.
G.	Des Grafen, of the count.	Der Grafen, of the counts.
D.	Dem Grafen, to the count.	Den Grafen, to *or* for the counts.
A.	Den Grafen, the count.	Die Grafen, the counts.
N.	Der Falke, the falcon.	Die Falken, the falcons.
G.	Des Falken, of the falcon.	Der Falken, of the falcons.
D.	Dem Falken, to the falcon.	Den Falken, to the falcons.
A.	Den Falken, the falcon.	Die Falken, the falcons.

Feminine nouns which are indeclinable in the singular for the most part follow this declension in the plural. Those ending in the suffix -in in the singular, double the n in the plural.

EXAMPLES.

	Singular.	*Plural.*
N.	Die Schuld, the debt.	Die Schulden, the debts,
G.	Der Schuld, of the debt.	Der Schulden, of the debts.
D.	Der Schuld, to the debt.	Den Schulden, to the debts.
A.	Die Schuld, the debt.	Die Schulden, the debts.
N.	Die Hirtin, the shepherdess.	Die Hirtinnen, the shepherdesses.
G.	Der Hirtin, of the shepherdess.	Der Hirtinnen, of the shepherdesses.
D.	Der Hirtin, to the shepherdess.	Den Hirtinnen, to the shepherdesses.
A.	Die Hirtin, the shepherdess.	Die Hirtinnen, the shepherdesses.

Mutter (mother) and Tochter (daughter) are in the plural Mütter and Töchter. They add n to the dative.

All feminine nouns were originally in the singular declined according to the New Declension. These old inflected forms are still preserved in certain phrases. Thus, mit *or* in Ehren, "with *or* in respect *or* honour"—Ehren, from Ehre; auf Erden, "on earth"—Erden, from Erde; mit Freuden, "with joy"—Freuden, from Freude; von *or* auf Seiten, "on the part of"—Seiten, from Seite; meiner Frauen Schweſter, "my wife's sister."

OBSERVATIONS ON THE DECLENSION OF COMMON NOUNS.

Some nouns have no singular. This arises naturally from their meaning, and frequently happens in English as well as in German. It will be seen by the following list that in the case of some words the English and German languages agree in having no singular:—

Ahnen, ancestors.
Alpen, Alps.
Altern (Eltern), parents.
Beinkleider, small clothes.
Blattern, small-pox.
Briefſchaften, letters, papers.
Einkünfte, revenue.
Faſten, Lent, fasts.
Ferien, holidays.
Fußſtapfen, footsteps.
Gebrüder, brothers.
Geſchwiſter, brothers and sisters.
Gliedmaßen, the limbs.
Händel, quarrels.
Hoſen, trousers.
Inſignien, marks, badges.
Koſten *and* Unkoſten, costs.
Leute, people, folk.
Maſern *and* Rotheln, measles.
Molken, whey.
Oſtern, Easter.
Pfingſten, Whitsuntide.
Ränke, tricks.
Repreſſalien, reprisals.
Träber *or* Treber, husks, lees.
Trümmer, ruins.
Weihnachten, Christmas.

NOTE.—Leute merely expresses plurality of persons. In this it differs from Menſchen (human beings), which has regard to the kind or species, as also from Männer (men), which denotes particularly the sex. Those compounds, however, of which in the singular Mann forms the last part, take generally, in the plural, Leute instead of Männer. Thus:—

Singular.	*Plural.*
Arbeitsmann, workman.	Arbeitsleute, workpeople.
Edelmann, nobleman.	Edelleute, noblemen.
Kaufmann, merchant.	Kaufleute, merchants.
Landmann, countryman.	Landleute, country people.

The distinctive difference between Leute and Männer may be forcibly shown by reference to the words Eheleute and Ehemänner. Eheleute means "married *people*"; Ehemänner signifies "married *men*" (*i.e.*, husbands).

Some have no plural, according to the following heads:—

(*a*) Generic names of material substances, as:—Das Gold, gold; Silber, silver; Eiſen, iron, etc.

(*b*) General terms and those expressive of abstract ideas, as:—Raub, pillage; Ruhm, glory; das Vieh, cattle; Vernunft, reason; Stolz, pride; Kälte, cold, etc.

(*c*) Some names of plants, as:—Der Kohl, the cabbage; Hopfen, hops; Kreſſe, cresses, etc.

(*d*) All infinitives employed as nouns, as also all neuter adjectives so employed, as:—Leben, life; Verlangen, wish; das Weiß, white, etc.

(*e*) Nouns denoting quantity, number, weight, or measure; as:—Bund, bundle; Dutzend, dozen; Grad, degree; Pfund, pound; Zoll, an inch, etc.

Thus, in German, we say neun Klafter, nine fathoms; hundert Grad, a hundred degrees, etc. Feminines ending in -e, and words denoting periods of time, as also the names of coins, are in general excepted from this rule.

Some in the plural have two forms, conveying in general different, though kindred, significations, as in the following examples:—

Singular.	*Plural.*	
Das Band,	Bande, bonds, fetters.	Bänder, ribbons.
Die Bank,	Bänke, benches.	Banken, banks of commerce.
Der Bogen,	Bogen, sheets of paper.	Bögen, arches, bows.
Das Ding,	Dinge, things in general.	Dinger, little creatures.
Der Dorn,	Dornen, thorn-bushes.	Dörner, thorns (more than one).
Der Fuß,	Füße, feet.	Fuße, feet (as measures).
Das Geſicht,	Geſichte, visions, sights.	Geſichter, faces.
Das Horn,	Horne, sorts of horn.	Hörner, horns (more than one).
Das Holz,	Holze, sorts of wood.	Hölzer, pieces of wood.
Der Laden,	Laden, shutters.	Läden, shops.
Das Land,	Lande, regions.	Länder, states.
Der Mann,	Männer, men.	Mannen, vassals.
Der Mond,	Monden, months.	Monde, planets.
Der Ort,	Orte, places (any).	Örter, places (particular).
Die Sau,	Sauen, wild boars.	Säue, swine.
Die Schnur,	Schnüre, tapes.	Schnuren, daughters-in-law.
Der Strauß,	Sträuße, nosegays.	Straußen, ostriches.
Das Wort,	Wörter, words unconnected (as in a dictionary).	Worte, words (in a sentence).
Der Zoll,	Zolle, inches.	Zölle, tolls.

FOREIGN NOUNS.

Some nouns introduced from foreign languages retain their original terminations, as:—Der Medicus, a physician; plur. Medici, physicians; Factum, deed; Facta, deeds.

Some masculines and neuters from the French and the English merely affix s to the genitive singular, which is retained in all the cases of the plural, as:—Nom. der Lord, the lord; gen. des Lords, of the lord; plur. die Lords, the lords, etc.; der Chef, the chief; gen. des Chefs, of the chief; plur. die Chefs, the chiefs, etc.

FOREIGN NOUNS OF THE OLD DECLENSION.

Foreign nouns of the neuter gender, as also most of the masculines, are of the Old Declension.

Among the masculines must be noted those appellations of persons ending in the following terminations:—

-al: as, Kardinal, cardinal.
-ar: as, Notar, notary.
-an: as, Kaſtellan, castellan.

To which may be added:—Abt, abbot; Propſt, provost; Papſt, pope; Biſchof, bishop; Bürgermeiſter, mayor; Spion, spy; Patron, patron; Offizier, officer.

Some have in the plural the form -er (e + r), as:—Hoſpital, hospital; Spital, hospital; Kamiſol, waistcoat; Regiment, regiment: plur. Hoſpitäler, hospitals; Spitäler, hospitals, etc.

Some in the plural soften the radical vowels, as:—Abt, abbot; Altar, altar; Biſchof, bishop; Chor, choir; Choral, choral-song; Hoſpital, hospital; Spital, hospital; Kanal, canal; Caplan, chaplain; Kardinal, cardinal; Kloſter, cloister; Marſch, marsh; Moraſt, morass; Palaſt, palace; Papſt, pope; Propſt, provost: plur. Äbte, abbots; Altäre, altars; Biſchöfe, bishops, etc.

FOREIGN NOUNS OF THE NEW DECLENSION.

To the New Declension belong all foreign nouns of the feminine gender, and nearly all masculines which are the appellation of *persons*, and some which are not, as:—Der Student, the student; der Juriſt, the lawyer; der Elephant, the elephant; der Ducat, the ducat; der Komet, the comet; der Planet, the planet; der Konſonant, the consonant; der Prinz, the prince; der Tyrann, the tyrant, etc.

FOREIGN NOUNS PARTLY OF THE OLD AND PARTLY OF THE NEW DECLENSION.

These are: *First*, Neuters ending in -ſiv, as:—Das Paſſiv, the passive; gen. Paſſivs, of the passive; plur. Paſſiven, the passives. *Secondly*, Titles of males in -or, as:—Doctor, a doctor; gen. Doctors, of a doctor; plur. Doctoren, doctors. *Thirdly*, Neuters ending in -al, -il, and -um, which also often have i before the -en of the plural, as:—Kapital, a capital; plur. capitals; Foſſil, a fossil; plur. Foſſilien, fossils; Studium, study; plur. Studien, studies. *Fourthly*, The following masculines:—Faſan, pheasant; Kapaun, capon; Konſul, consul; Pantoffel, slipper; Präfekt, prefect; Pſalm, psalm; Rubin, ruby; Staat, state; Traktat, treatise. To which add Inſekt, insect; Atom, atom; Pronom, pronoun; Statut, statute; and Verb, verb, which are neuters.

DECLENSION OF PROPER NOUNS.

SINGULAR NUMBER.

Names of males and females, except when the latter terminate in -e, take s to form the genitive, which is their only variation, as:—

Nom.	Heinrich, Henry.	Eliſabeth, Elizabeth.
Gen.	Heinrichs, of Henry.	Eliſabeths, of Elizabeth.
Dat.	Heinrich, to Henry.	Eliſabeth, to Elizabeth.
Acc.	Heinrich, Henry.	Eliſabeth, Elizabeth.

It is customary with some writers to affix en to the dative and accusative of proper names; but the better usage distinguishes these cases by prefixing the article: as, nom. Leſſing, Lessing; gen. Leſſings, of Lessing; dat. dem Leſſing (instead of Leſſingen), to Lessing; acc. den Leſſing (instead of Leſſingen), Lessing.

Names of females ending in -e form the genitive in -ens and the dative in -en. Those of males ending in -s, -ſs, -ſch, -x, or -z, take likewise in the genitive -ens, as:—

N.	Luiſe, Louisa.	Leibnitz, Leibnitz.	Voß, Voss.
G.	Luiſens, of Louisa.	Leibnitzens, of Leibnitz.	Voſſens, of Voss.
D.	Luiſen, to Louisa.	Leibnitz, to Leibnitz.	Voß, to Voss.
A.	Luiſe, Louisa.	Leibnitz, Leibnitz.	Voß, Voss.

Names, whether of males or females, when preceded by an article, are indeclinable, as:—

N.	Der Schiller, the Schiller.	Die Luiſe, the Louisa.
G.	Des Schiller, of the Schiller.	Der Luiſe, of the Louisa.
D.	Dem Schiller, to the Schiller.	Der Luiſe, to the Louisa.
A.	Den Schiller, the Schiller.	Die Luiſe, the Louisa.

PROPER NOUNS IN THE PLURAL.

Proper nouns when employed in the plural conform for the most part to the rules for the declension of common nouns; the masculines being varied according to the Old Declension, and the feminines according to the New.

Sometimes the plural is made by the addition of s to the singular, as:—Die Schillers, the Schillers; die Herders, the Herders. Those ending in -o add for the plural -ne or -nen, as:—Cato, Cato; nom. plur. Catone *or* Catonen, the Catos, etc.

Their inflection is in no wise affected by the presence of the article, nor do the radical vowels a, o, u, au, ever assume the Umlaut.

EXAMPLES.

N.	Die Leibnitze, the Leibnitzes.	Die Schlegel, the Schlegels.
G.	Der Leibnitze, of the Leibnitzes.	Der Schlegel, of the Schlegels.
D.	Den Leibnitzen, to the Leibnitzes.	Den Schlegeln, to the Schlegels.
A.	Die Leibnitze, the Leibnitzes.	Die Schlegel, the Schlegels.
N.	Die Luiſen, the Louisas.	Die Annen, the Annes.
G.	Der Luiſen, of the Louisas.	Der Annen, of the Annes.
D.	Den Luiſen, to the Louisas.	Den Annen, to the Annes.
A.	Die Luiſen, the Louisas.	Die Annen, the Annes.

PROPER NAMES OF COUNTRIES, CITIES, ETC.

Proper names of places admit of no changes of form for the purposes of declension beyond the mere addition of s to the genitive singular, as:—Berlin, Berlin; gen. Berlins, of Berlin.

If, however, the word end in a sound not easily admitting an s after it, the case is distinguished by placing before it a noun preceded by the article; or it is expressed by the preposition von, as:—Die Stadt Mainz, the city Mayence; Die Einwohner von Paris, the inhabitants of Paris.

OBSERVATIONS.

When several proper names belonging to the same person, and not preceded by the article, come together, the last one only is declined; as:—Johann Chriſtoph Adelungs Sprachlehre, John Christopher Adelung's grammar. If, however, the article precede, none of them undergo change, as:—Die Werke des Johann Gottlob Herder, the works of John Gottlob Herder.

When a common and a proper name of the same person, preceded by the article, concur, the common noun alone is inflected, as:—Der Tod des Königs Ludwig, the death of King Louis. If no article precede, the proper noun is declined, as:—König Ludwigs Tod, King Louis' death.

When a Christian name is separated from a family name by a preposition (especially von), the Christian name only admits of declension, as:—Die Gedichte Friedrichs von Schiller, the poems of Frederick of Schiller. If, however, the genitive precede the governing noun, the family name only takes the sign of declension, as:—Friedrich von Schillers Werke, Frederick of Schiller's works.

ADJECTIVES.

Adjectives are in German generally so varied in termination, as to indicate thereby the gender, number, and case of the words with which they are joined. Before treating of their inflection, however, we shall present and explain those significant suffixes which are most commonly employed in forming adjectives from other words.

Here, as was done in the case of derivative nouns, each suffix is given with its corresponding English equivalent, its meaning explained, and its use further illustrated by a series of examples.

SUFFIXES USED IN FORMING ADJECTIVES.

SUFFIXES.	ENGLISH EQUIVALENTS.	
-bar	[*-able*, *-ible*, *-ile*]	implies *ability;* sometimes *disposition.*
-en -ern	[*-en*]	points to something *made of* that expressed by the radical.
-haft	[*-ive*, *-ish*, *-ous*]	denotes *tendency* or *inclination;* also *resemblance.*
-ig	[*-y*, *-ful*]	represents a thing as being *full of* that denoted by the radical.
-icht	[*-y*, *-ous*, *-ish*]	denotes *similarity of nature* or *character.*
-lich	[*-ly*, *-ish*, *-able*]	implies *likeness* or *sameness* either of manner or degree; also *ability.*
-iſch	[*-ish*, *-some*, *-al*]	represents something as *pertaining* or *belonging to.*
-ſam	[*-some*, *-able*]	expresses *inclination;* sometimes *ability.*

EXAMPLES.

SUFFIXES.		WORDS.
-bar	Dienſtbar,	serviceable, tributary.
	Sichtbar,	that *can be* seen; visible.
-en	Golden,	*made of* gold; golden.
-ern	Bleiern,* [Blei-er-(e)n]	*made of* lead; leaden.
-haft	Tugendhaft,	*inclined to* virtue; virtuous.
	Meiſterhaft,	*resembling* a master; masterly.
-ig -icht	Blumig,	*full of* flowers; *abounding in* flowers.
	Blumicht,	flowery; that is, *like* flowers.
	Waldig,	woody; that is, *abounding in* woods.
	Salzicht,	saltish; somewhat *like* salt.
-lich	Brüderlich,	brotherly, or *like* a brother.
	Kränklich,	sickly.
	Süßlich,	sweetish; somewhat sweet.
	Beweglich,	movable.

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* The letters er in this word are simply *euphonic;* while the e of the suffix -en is dropped also for euphony.

-iſch	Irdiſch,	earthly; *belonging to* earth.
	Poetiſch,	poetical.
	Zänkiſch,	quarrelsome.
-ſam	Arbeitſam,	*inclined* to work; diligent
	Folgſam,	*inclined* to follow (orders); that is, obedient.

-iſch is the ending commonly added to names of places pointing to things belonging to them, as:— Engliſch, ſchwediſch, etc. If, however, a name be a town, the suffix -er is used in place of -iſch, as:— Das Merſeburger Bier, the Merseburg beer.

great variety of structure, of which our somewhat isolated remaining groups are but a remnant. Gymnosperms are undoubtedly lower in organisation than angiosperms, being in many respects intermediate between that division and the higher cryptogams (Pteridophyta), so as to represent somewhat closely the ancestral type, at least of dicotyledons.

In having two cotyledons, a tap-root, and an exogenous stem, they are certainly nearer to dicotyledons than to monocotyledons; but the stem is sometimes unbranched and the branches seldom have anything like as large a girth in proportion to the main trunk as in dicotyledons. The continued presence of a terminal bud or "leader," and the consequently monopodial character of the branching, where any occurs, is also characteristic, and the leaves are often reduced in size and simple in outline and venation. The protoxylem of gymnosperms resembles that of dicotyledons, but the secondary wood has no parenchyma and no true vessels, consisting mainly of *tracheides*, long prosenchyma cells with bordered pits mainly on their radial walls. The medullary rays are often only one-cell broad. Soft bast predominates in the phloem. The leaves generally receive two parallel fascicular bundles which may bifurcate, but do not form a network of veins and do not usually project on the surface of the leaves. The leaves are

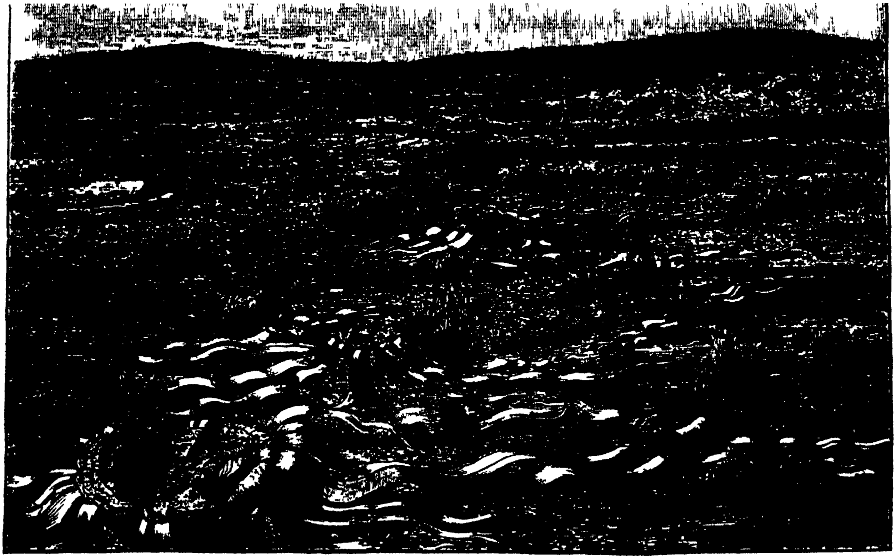


Fig. 90.—WELWITSCHIA MIRABILIS (AFTER MONTEIRO).

BOTANY.—XXI.

[*Continued from Vol. V., p.* 366.]

GYMNOSPERMIA.

WE have now dealt with all the various groups of angiosperms, or flowering plants having their ovules in closed ovaries, and we come next in descending order (*see* Vol. IV., p. 355) to the *Gymnospermia*. This group, though only containing one class, is of equal structural importance with the whole of the angiosperms, and so ranks also as a division. Though now only represented by three orders containing about 50 genera and less than 500 species, the gymnosperms are a group of far greater geological antiquity than angiosperms (*see* Vol. III., p. 366), and, when they were the chieftains of the plant-world, no doubt presented a generally evergreen, and have a strongly cuticularised epidermis with numerous sunken stomata. Intercellular longitudinal passages lined with an "epithelium" secreting gum or resin are common in the pith, wood, cortex, and leaves.

Though in the structure of their vegetative organs the gymnosperms are not widely dissimilar to the dicotyledons, when we examine their reproductive structures we find a very great difference. The flowers in all known existing species of gymnosperms are unisexual, the plants being either monœcious, or, less commonly, diœcious. There is seldom any trace of a perianth, and the floral axes are usually much elongated and bear the floral leaves (*sporophylls*) in spirals. In fact, in interpreting the structures that make up the flower we have constantly to bear in mind the definition of a flower as essentially an axis bearing sporophylls (*see* Vol. III., p. 379).

The stamens clearly exhibit their foliar nature, though they are sometimes peltate. The pollen-sacs, which open longitudinally, are two or more in number on each stamen, and are always outgrowths from the under surface of the staminal leaf. The pollen-grains divide into two or more cells before pollination, each containing a nucleus, the smaller cells being included within the larger one, which gives rise to the pollen-tube.

The female flowers vary considerably in the different groups, in some cases bearing the ovules directly on the axis, no carpels being present, whilst in others the ovules are on the margins, or in the axils, of the carpels. The carpels may close round the seed after fertilisation, but in no case is there a true ovary before fertilisation, or any style or stigma. The ovule has usually no primine, and its embryo-sac is formed at some distance from its micropyle. Before fertilisation free cells are formed within the embryo-sac, corresponding probably to the transitory antipodal cells in angiosperms (*see* Vol. IV., p. 187). These unite to form a tissue which increases by cell-division. This tissue is the *female prothallus* or *archisperm* (*loc. cit.*) and, though formerly called endosperm, should not be confounded with the tissue also so called, though preferably known as metasperm, in angiosperms, which originates from the secondary nucleus of the embryo-sac. On the archisperm several bodies known as *archegonia*, formerly called *corpuscula*, arise. Each *archegonium* originates in a single cell of the prothallus which divides into an upper or *neck-cell* and a lower or *central cell*. The *neck-cell* generally divides into a *rosette* of four so-called *stigmatic cells*, corresponding to the synergidæ of angiosperms (Vol. IV., p. 187). The upper part of the central cell is separated off and is known as the *canal-cell*, the remaining and larger portion being the *oosphere*. The pollen-grains are carried by wind to the micropyle of the ovule, where a drop of liquid is secreted which retains them. They then send their pollen-tubes through the tissue of the upper part of the tercine and between the neck or stigmatic cells of the archegonium until they come in contact with the oosphere; but the pollen-tubes often take more than a year in completing this penetration. After fertilisation the lower part of the oosphere divides into several rows of cells known as *suspensors* or *pro-embryos* which may give rise to one joint embryo, or may each give rise to a separate rudimentary one. From this cause and from the fertilisation of the oospheres of several archegonia the immature seed commonly contains several rudimentary embryos; but only one, as a rule, comes to anything.

The ripe seed is always filled with archisperm, the embryo lying straight in the centre with its radicle towards the micropyle. The two cotyledons are sometimes so deeply lobed as to be described as numerous, the whole group having thence been called *Polycotyledones*. They contain chlorophyll whilst still within the seed, being in this respect one of the chief exceptions to the rule that this substance is not formed in the absence of light.

The chief distinctions, therefore, between these gymnosperms and angiosperms are: (i.) the naked ovules and absence of style or stigma, if not of carpels altogether; (ii.) the formation of archisperm and (iii.) archegonia; and (iv.) the presence of distinct "included cells" or male prothallus in the pollen-grain.

The *Gymnospermia* are divided into three orders, the *Gnetaceæ*, *Coniferæ*, and *Cycadeæ*. The *Gnetaceæ* includes the three genera *Gnetum*, occurring in India and Guiana, *Ephedra* in temperate regions in Europe, Asia, and South America, and *Welwitschia* in Angola. *Gnetum* and *Ephedra* have jointed stems, generally shrubby, with opposite leaves, which are minute in *Ephedra*, but large, petiolate, lanceolate, and pinnately veined in *Gnetum*. The male flowers have a rudimentary perianth, and the outer coat of the ovule is prolonged upwards like a style. *Welwitschia mirabilis*, the only known species, growing in the sandy desert regions of Angola, where it was discovered by Dr. Welwitsch, is, perhaps, the most wonderful of flowering plants (Fig. 90). It has two cotyledons when germinating, which are soon shed; a woody, branched tap-root and a trunk about two feet high. This trunk, in addition to its ring of fibro-vascular bundles, has others scattered, as in monocotyledons, through the fundamental tissue, some of the cells of which tissue are encrusted with crystals of carbonate of lime. The trunk terminates above in an irregularly lobed, saddle-like mass, four or five feet across, marked on its upper surface by concentric lines. From a groove beneath the edge of this mass spring the only two foliage-leaves of the plant, opposite, broad, leathery, about six feet in length, trailing on the ground and torn into thong-like strips by the wind. They are in position at right angles to the deciduous cotyledons. From the edge of the disc spring the flowering branches, less than a foot in height, each of which is a dichasial cyme bearing bracts and cones which become scarlet when ripe. The scales are in four vertical rows. The male and female flowers are in separate cones and both have a perianth. The male flower is "pseudo-hermaphrodite" having a central sterile ovule surrounded by six stamens. These latter are monadelphous below, and have spherical trilocular anthers dehiscing by a three-rayed fissure at the apex. In germination the embryo sends out a *haustorium* or sucker into the archisperm.

The *Coniferæ* are by far the largest order among gymnosperms, containing about 40 genera with over 300 species. They occur in all regions and climates, often gregariously so as to form vast forests of a single species, especially in the colder regions of the northern hemisphere. The stem grows indefinitely to a height of from one to three hundred feet, never terminating in a flower; and, as it increases in diameter, sometimes to its base, forms a slender cone. Branches are produced freely, but in the axils only of some of the leaves, and often in terminal rosettes or successional whorls, every parent axis growing, as a rule, more strongly than its lateral axes. As the branching often begins near the ground, the whole tree may have a pyramidal outline. The leaves are mostly evergreen, entire, relatively small, narrow, rigid, and pointed; scale-leaves and foliage-leaves sometimes occurring together. In *Pinus* the persistent woody shoots bear only membranous scale-leaves, in the axils of which short deciduous branches are produced, bearing two, three, or five prismatic needle-shaped leaves. The leaves are commonly arranged spirally, and in larches and cedars are in tufts (*fasciculate*), but in the juniper they are in whorls of three, and in the yew, silver fir (*Abies pectinata*), and many others, the branch-systems form "sprays," each lying in one horizontal plane, and the leaves become apparently distichous and dorsi-ventral in comb-like rows (whence the name *pectinata*) by a twisting of their short petioles. The leaves of larch and of *Gingko*, the maiden-hair tree, are deciduous; whilst in *Taxodium distichum*, the deciduous cypress of the Mississippi, not only the leaves, but also the short branches which bear them and which resemble pinnate leaves, fall in the autumn.

The flowers may be monœcious or diœcious, and from the elongation of their axes are sometimes erroneously termed catkins, the true catkin, such as that of a hazel, being an inflorescence, not a flower. The arrangement of the sporophylls is generally the same as that of the foliage-leaves. In the Scots fir or pine, *Pinus sylvestris*, the catkin-like male flowers occur many together, replacing the needle-bearing shoots in the axils of the scale-leaves, the main mother-shoot being elongated as a leafy branch through the centre of the inflorescence. (*See* Coloured Plate, Types of Plant Life, Vol. III., Fig. 12.)

The stamens or male sporophylls in the order are undoubted phyllomes, having generally a stalk or *filament*, and a peltate lamina bearing two or more pollen-sacs on its under side. Pollen is produced in great quantities, so as to cause in some districts what has been termed "sulphur rain"; and, to aid its dispersal by the wind, the grains in *Pinus*, *Abies*, etc., are often furnished with bladder-like expansions of the extine.

The female flowers differ considerably in the various tribes or families into which the order is subdivided. Thus, in the yew (*Taxus*) a single ovule without carpel or perianth terminates a short leafy branch; in the maiden-hair tree (*Gingko biloba*) two similarly naked ovules generally occur laterally on the end of a branch; and in most of the other types there is the well-known *cone*. The nature of the cone can hardly be said to have been as yet satisfactorily settled, some authorities regarding it as a single flower with an elongated axis, whilst others look upon it as an inflorescence, each scale of which constitutes a separate flower. In the cowdie pine of New Zealand and dammar pine of India (*Dammara*), each scale of the cone (*female sporophyll*) bears one ovule or *macrosporangium* on its upper surface, unlike the pollen-sacs, which are always on the under-surface of the sporophyll. In the puzzle-monkeys (*Araucaria*) the arrangement is similar, but there is a "ligular outgrowth" above the ovule. In the deciduous cypress (*Taxodium*), and its allies the redwoods of California (*Sequoia*), *Cryptomeria*, etc., this outgrowth develops into a special scale known as the *seminiferous scale*, whilst the sporophyll itself has been termed the *bract-scale*. In the pines (*Pinus*), firs (*Abies*), spruces (*Picea*), larches (*Larix*), cedars (*Cedrus*), etc., there are two ovules on each seminiferous scale, this scale being apparently a placental outgrowth from the bract-scales or open carpels which it outstrips in growth.

When the seeds are ripe the seminiferous scales in firs and spruces become woody, but remain thin and flat, whilst in pines they thicken at the apex into rhomboidal ends or *apophyses*, which in the unopened cone meet as the *tessellæ* of its surface. In the cypresses (*Cupressus*), junipers (*Juniperus*), arbor-vitæ (*Thuja* and *Biota*), etc., there is no seminiferous scale, the ovules being on a slight swelling in the axils of the cone-scales, which at first differ but little from foliage-leaves. Afterwards these scales cohere and form a sort of fruit, which in the juniper is a fleshy baccate structure. In this latter case the cone consists of only three scales, which are in a whorl like the foliage-leaves, and the three ovules are in their axils, but alternating with them.

The ovules in all conifers have no primine, and are originally erect and atropous, but in many cases become subsequently inverted. The secundine generally forms a wide-mouthed micropyle, in which a drop of liquid is secreted, by which the pollen-grain is received and drawn down (on evaporation) to the top of the tercine. The pollen-tube penetrates a short distance into the tissue of the tercine, and then ceases to elongate for some weeks or months. Meanwhile the embryo-sac, having originated deep down below the apex of the tercine, has become filled with the archisperm or female prothallium, a tissue which is first formed by the division of the nucleus of the embryo-sac. Single cells on the upper surface of the prothallium give rise to the archegonia, each of which divides into a large *central cell* below and a *neck* above. The neck may remain a single cell, or may become a rosette of four cells, or several tiers of four or eight cells each. The nucleus of the central cell divides, and so forms a *ventral canal-cell* just below the neck, the remaining contents of the central cell being the *oosphere*. The archegonia are commonly three to five in number, but may be as many as fifteen or thirty.

The pollen-tube on reaching the necks of the archegonia widens out over them, and sends out one or more narrow protuberances between the neck-cells. The *included cells*, or *male prothallium*, in the pollen-grain take no part in the process of fertilisation; but the nucleus of the large main cell of the grain (*antheridium*) divides into two parts, the *vegetative* and *reproductive nuclei*, the latter of which will divide again in those cases where one pollen-tube fertilises several archegonia. Meanwhile the ventral canal-cell becomes disorganised; and as two nuclei, the male or sperm and female or germ, have been seen to coalesce within the oosphere, it is probable that the former of these is the reproductive nucleus which disappears from the pollen-tube, and that it passes in some way through a thin spot or pit at the point of the protuberance from the pollen-tube.

The fertilised oosphere or *oospore* gives rise to one, or more often to four, *suspensors* terminating in rudimentary embryos; and as several archegonia are fertilised on each prothallium, each seed contains many embryos. This *polyembryony*, as it is called, which is thus the rule among conifers, is exceptional among angiosperms. Of these rudimentary embryos, however, only one develops.

While the seeds are ripening various accessory parts enlarge. In the yew the pink fleshy cup-shaped aril grows up round the seed (*see* Coloured Plate, Types of Plant Life, Vol. III., Fig. 11); in the junipers the cone-scales develop into the blue fleshy "berry"; and in pines, firs, spruces, larches, and cedars, the seminiferous scales become woody. The wings of the seeds in these genera are plates of tissue separated from the seminiferous scales.

The order is divided into two sub-orders, the *Araucariaceæ* and the *Taxineæ*, the former of which contains the tribes *Araucarieæ*, *Taxodineæ*, *Abietineæ*, and *Cupressineæ*. The *Araucarieæ*, trees with branches in whorls and spiral leaves, include the Chilian pine or puzzle-monkey (*Araucaria imbricata*), the Moreton Bay pine (*A. Bidwillii*), the Norfolk Island pine (*A. excelsa*), and the cowdie pine of New Zealand (*Dammara australis*), yielding gum-dammar. The *Taxodieæ* include the deciduous cypress (*Taxodium distichum*) of the United States and the mammoth tree or wellingtonia (*Sequoia gigantea*) of California, which reaches a height of 360 feet. The *Abietineæ*, with two ovules to each scale and winged pollen and seeds, include *Abies*, *Picea*, *Tsuga*, *Pseudotsuga*, *Larix*, *Cedrus*, and *Pinus*. *Abies*, the firs, including *A. pectinata*, the silver fir, has white lines of stomata on the under surface of its acicular leaves, and erect cones which fall to pieces when ripe. *Picea*, the spruces, including *P. excelsa*, the Norway spruce, have four-angled leaves and pendulous cones which fall off whole. *Tsuga canadensis* is the hemlock spruce and *Pseudotsuga Douglasii*, the Oregon pine or Douglas fir, valuable timber-trees. *Larix europæa* and other larches differ from cedars in their fasciculate leaves being deciduous. *Cedrus* includes *C. Libani*, the Lebanon cedar, with horizontal, *C. Deodara*, the deodar of India, with drooping, and *C. atlantica*, the Atlas cedar, with ascending branches. *Pinus*, with needle-leaves in the axils of scale-leaves, includes *P. sylvestris*, the Scots fir or northern pine, *P. Pinaster*, the cluster pine, and *P. Pinea*, the stone pine of Southern Europe, with two needles on each dwarf shoot; *P. Strobus*, the Weymouth pine, with five; and many other species yielding valuable timber (deal), turpentine, resin, and pitch. The *Cupressineæ*, with leaves and cone-scales in whorls, include the cypresses, junipers, and arbor-vitæ. The "pencil cedars" are West Indian junipers. The shoots of arbor-vitæ, branching in one plane and bearing minute adpressed leaves, resemble leaves.

The yew tree (*Taxus baccata*) has spiral, but apparently distichous, evergreen leaves, light green below, but without white lines; is diœcious, and differs from most other gymnosperms in not being resinous. It grows slowly, and attains a great age.

The *Cycadeæ* are at the present day natives chiefly of the tropics, but are found fossil, especially in Secondary rocks, in England and elsewhere. They have generally large, cylindrical, unbranched stems, resembling those of tree-ferns, covered with the scars of fallen leaves, and surmounted by a crown of large, leathery, pinnate leaves. They are diœcious, the flowers being cones either of peltate stamens bearing numerous pollen-sacs (*microsporangia*) on their under surface, or of carpels. These latter differ in form, those of *Cycas* being small pinnate leaves with their lower lobes converted into ovules which have a fleshy coat and become as large as plums. The starchy fundamental tissue of the stems of various forms of cycads yield sagos, whence their name "Caffer-bread."

PLANE TRIGONOMETRY.—IV.

[*Continued from Vol. V., p.* 369.]

SUPPLEMENTAL ANGLES (*continued*).

XVIII. *Application of the foregoing Formulæ.*—It will be readily seen how the power to work out numerical values for functions of different angles is extended by the results of the last few sections. We may now obtain values for the half or third, or for twice or three times any of the angles whose values were computed geometrically in Section V., and for any combinations arising by addition or subtraction of angles so calculated. In this way, by steps which cannot be followed here, the entire table of natural sines and cosines has been constructed, and by means altogether foreign to this treatise the corresponding logarithms have been worked out for every degree and minute from 0° to 90° (*see*, amongst other works, Galbraith and Haughton's "Mathematical Tables"). Moreover, the numerous formulæ derived from the "four fundamental formulæ" are of great use in helping us to simplify trigonometrical expressions, and to change them into forms more suitable for logarithmic calculation, or otherwise more convenient to deal with. The following cases, given as examples, show how apparently formidable expressions can be turned into simple ones, easily solved, by mere knowledge how to make use of the formulæ:—

1. Reduce $\frac{1-\cos. A}{\sin. A}$ to a single trigonometrical function. By (63) and (60)—

$$\frac{1-\cos. A}{\sin. A}=\frac{2\sin.^2\frac{1}{2}A}{2\sin.\frac{1}{2}A\cos.\frac{1}{2}A}=\frac{\sin.\frac{1}{2}A}{\cos.\frac{1}{2}A}=\tan.\frac{1}{2}A.$$

2. Simplify $\frac{1+\cot.^2 A}{2\cot. A}$. By (25) and (52)—

$$\frac{1+\cot.^2 A}{2\cot. A}=\frac{\operatorname{cosec.}^2 A}{2\cot. A}=\frac{1}{\sin.^2 A}\cdot\frac{\sin. A}{2\cos. A}$$
$$=\frac{1}{2\sin. A\cos. A}=\frac{1}{\sin. 2A}=\operatorname{cosec.} 2A.$$

3. Reduce cosec. A + cot. A to a single function. By (62) and (60)—

$$\operatorname{Cosec.} A+\cot. A=\frac{1}{\sin. A}+\frac{\cos. A}{\sin. A}=\frac{1+\cos. A}{\sin. A}$$
$$=\frac{2\cos.^2\frac{1}{2}A}{2\sin.\frac{1}{2}A\cos.\frac{1}{2}A}=\frac{\cos.\frac{1}{2}A}{\sin.\frac{1}{2}A}=\cot.\frac{1}{2}A.$$

4. Express tan. A + cot. A by a single function.

$$\operatorname{Tan.} A+\cot. A=\frac{\sin. A}{\cos. A}+\frac{\cos. A}{\sin. A}=\frac{\sin.^2 A+\cos.^2 A}{\sin. A\cos. A}$$
$$=\frac{1}{\sin. A\cos. A}=\frac{2}{2\sin. A\cos. A}=\frac{2}{\sin. 2A}$$
$$=2\operatorname{cosec.} 2A.$$

5. Reduce $\frac{\sin. A}{1+\cos. A}$ to a single function. This is similar to Case 1.

$$\frac{\operatorname{Sin.} A}{1+\cos. A}=\frac{2\sin.\frac{1}{2}A\cos.\frac{1}{2}A}{2\cos.^2\frac{1}{2}A}=\frac{\sin.\frac{1}{2}A}{\cos.\frac{1}{2}A}=\tan.\frac{1}{2}A.$$

6. Express $\frac{\cos. A}{1+\sin. A}$ by a single function. This is again similar.

$$\frac{\operatorname{Cos.} A}{1+\sin. A}=\frac{\sin.(90^\circ-A)}{1+\cos.(90^\circ-A)}=$$
$$\frac{2\sin.(45^\circ-\frac{1}{2}A)\cos.(45^\circ-\frac{1}{2}A)}{2\cos.^2(45^\circ-\frac{1}{2}A)}=\frac{\sin.(45^\circ-\frac{1}{2}A)}{\cos.(45^\circ-\frac{1}{2}A)}$$
$$=\tan.(45^\circ-\frac{1}{2}A).$$

7. Bring cos.^{4} A – sin.^{4} A to a single function.

$$\operatorname{Cos.}^4 A-\sin.^4 A=(\cos.^2 A+\sin.^2 A)(\cos.^2 A-\sin. A)$$
$$=1\times\cos. 2A=\cos. 2A.$$

8. Bring sec. A + tan. A to a single function (remember that 90° + A = complement of A, and bear in mind signs of angles in second quadrant).

$$\operatorname{Sec.} A+\tan. A=\frac{1}{\cos. A}+\frac{\sin. A}{\cos. A}=\frac{1+\sin. A}{\cos. A}$$
$$=\frac{1-\cos.(90^\circ+A)}{\sin.(90^\circ+A)}$$
$$=\frac{2\sin.^2\frac{1}{2}(90^\circ+A)}{2\sin.\frac{1}{2}(90^\circ+A)\cos.\frac{1}{2}(90^\circ+A)}=\tan.(45^\circ+\frac{1}{2}A).$$

9. Reduce sin. A tan. $\frac{1}{2}$ A.

$$\operatorname{Sin.} A\tan.\frac{1}{2}A=2\sin.\frac{1}{2}A\cos.\frac{1}{2}A\cdot\frac{\sin.\frac{1}{2}A}{\cos.\frac{1}{2}A}$$
$$=2\sin.^2\frac{1}{2}A=1-\cos. A=\operatorname{versin.} A.$$

10. Simplify $\frac{\text{cot. A} + \text{tan. A}}{\text{cot. A} - \text{tan. A}}$.

$$\frac{\text{Cot. A} + \text{tan. A}}{\text{Cot. A} - \text{tan. A}} = \frac{\frac{\text{cos.}^2\text{A} + \text{sin.}^2\text{A}}{\text{sin. A cos. A}}}{\frac{\text{cos.}^2\text{A} - \text{sin.}^2\text{A}}{\text{sin. A cos. A}}} = \frac{\text{cos.}^2\text{A} + \text{sin.}^2\text{A}}{\text{cos.}^2\text{A} - \text{sin.}^2\text{A}}$$

$$= \frac{1}{\text{cos. 2 A}} = \text{sec. 2 A.}$$

11. Express $\frac{\text{sin. A} + \text{sin. 3 A}}{\text{cos. A} + \text{cos. 3 A}}$ by a single function.

By (41) and (43)—

$$\frac{\text{Sin. A} + \text{sin. 3 A}}{\text{Cos. A} + \text{cos. 3 A}} = \frac{2 \text{ sin. } \frac{\text{A} + 3 \text{ A}}{2} \text{ cos. } \frac{\text{A} - 3 \text{ A}}{2}}{2 \text{ cos. } \frac{\text{A} + 3 \text{ A}}{2} \text{ cos. } \frac{\text{A} - 3 \text{ A}}{2}}$$

$$= \text{tan. 2 A.}$$

12. Reduce $\frac{\text{sin. A} + \text{sin. 3 A} + \text{sin. 5 A}}{\text{cos. A} + \text{cos. 3 A} + \text{cos. 5 A}}$. Apply (41) and (43) as before, but only to first and last terms of numerator and denominator; then—

$$\frac{\text{sin. A} + \text{sin. 3 A} + \text{sin. 5 A}}{\text{cos. A} + \text{cos. 3 A} + \text{cos. 5 A}} = \frac{\text{sin. 3 A } (1 + 2 \text{ cos. 2 A})}{\text{cos. 3 A } (1 + 2 \text{ cos. 2 A})}$$

$$= \text{tan. 3 A.}$$

13. Show that sin. (A + B) sin. (A − B) = sin.^2 A − sin.^2 B. By (33) and (34)—

$$\text{Sin.(A+B) sin.(A−B)} = \text{sin.}^2\text{A cos.}^2\text{B} - \text{cos.}^2\text{A sin.}^2\text{B}$$

$$= \text{sin.}^2\text{A } (1 - \text{sin.}^2\text{B}) - \text{sin.}^2\text{B } (1 - \text{sin.}^2\text{A})$$

$$= \text{sin.}^2\text{A} - \text{sin.}^2\text{A sin.}^2\text{B} - \text{sin.}^2\text{B} + \text{sin.}^2\text{A sin.}^2\text{B}$$

$$= \text{sin.}^2\text{A} - \text{sin.}^2\text{B.}$$

14. Show that cos. (A + B) cos. (A − B) = cos.^2 A − sin.^2 B. Proceed as in last case, by (35) and (36).

15. Solve the equation, a tan. $x = b$ cos. x. Multiply both sides by cos. x; then—

$$a \text{ sin. } x = b \text{ cos.}^2 x = b\ (1 - \text{sin.}^2 x);$$

$$\therefore \text{sin.}^2 x + \frac{a}{b} \text{ sin. } x - 1 = 0;$$

$$\therefore \text{sin. } x = \frac{-a + \sqrt{4b^2 + a^2}}{2b}.$$

16. Show that tan.^2 A − tan.^2 B

$$= \frac{\text{sin. (A + B) sin. (A − B)}}{\text{cos.}^2\text{A cos.}^2\text{B}}.$$

$$\text{Tan.}^2\text{A} - \text{tan.}^2\text{B} = (\text{tan. A} + \text{tan. B})\ (\text{tan. A} - \text{tan. B})$$

$$= \left(\frac{\text{sin. A}}{\text{cos. A}} + \frac{\text{sin. B}}{\text{cos. B}}\right) \left(\frac{\text{sin. A}}{\text{cos. A}} - \frac{\text{sin. B}}{\text{cos. B}}\right)$$

$$= \left(\frac{\text{sin. A cos. B} + \text{cos. A sin. B}}{\text{cos. A cos. B}}\right)$$

$$\left(\frac{\text{sin. A cos. B} - \text{cos. A sin. B}}{\text{cos. A cos. B}}\right)$$

$$= \frac{\text{sin. (A + B)}}{\text{cos. A cos. B}} \cdot \frac{\text{sin. (A − B)}}{\text{cos. A cos. B}}$$

$$= \frac{\text{sin. (A + B) sin. (A − B)}}{\text{cos.}^2\text{A cos.}^2\text{B}}.$$

17. Solve the simultaneous equations,

$$\text{sin. } x + \text{sin. } y = a.$$

$$\text{cos. } x + \text{cos. } y = b.$$

By (41) and (43)—

$$2 \text{ sin. } \tfrac{1}{2} (x + y) \text{ cos. } \tfrac{1}{2} (x - y) = a.$$

$$2 \text{ cos. } \tfrac{1}{2} (x + y) \text{ cos. } \tfrac{1}{2} (x - y) = b.$$

Dividing the first equation by the second, we obtain

$$\text{tan. } \tfrac{1}{2} (x + y) = \frac{a}{b}.$$

Again, squaring both equations, and adding together we obtain

$$4 \text{ cos.}^2 \frac{x - y}{2} \left(\text{sin.}^2 \frac{x + y}{2} + \text{cos.}^2 \frac{x + y}{2}\right) = a^2 + b^2.$$

But the last factor of left-hand side = 1,

$$\therefore \text{cos.}^2 \tfrac{1}{2} (x - y) = \tfrac{1}{4} (a^2 + b).$$

From these two results the unknown quantities x and y may be found by addition and subtraction.

XIX. *Subsidiary Angles.*—Trigonometrical calculations may often be simplified in form by introducing a *subsidiary* or imaginary angle, by which the sum or difference of two or more magnitudes may be expressed by a product or quotient—often a matter of importance in calculating with logarithms. An example or two will best explain our meaning:—

Solve the equation, $x = a$ sin. A + b cos. A.

Now assume a subsidiary angle θ, such that $\frac{b}{a}$ = tan. θ, and substitute this value in above equation.

$$\text{Then } x = a \left(\text{sin. A} + \frac{b}{a} \text{ cos. A}\right)$$

$$= a\ (\text{sin. A} + \text{tan. } \theta \text{ cos. A})$$

$$= a \frac{\text{sin. A cos. } \theta + \text{sin. } \theta \text{ cos. A}}{\text{cos. } \theta}$$

$$= a \frac{\text{sin. (A} + \theta)}{\text{cos. } \theta}.$$

This is a much more manageable expression to deal with, θ being already known by the assumption. As tan. θ may be anything from 0 to ∞, the relative values of a and b are immaterial; but had it been desired to introduce sin. θ, it would have been necessary to see that the ratio assumed to represent it did not exceed unity, as sin. θ cannot exceed 1.

Solve the equation a sin. $x + b$ cos. $x = c$.

$$a \text{ sin. } x - c = -b \text{ cos. } x.$$

$$(a \text{ sin. } x - c)^2 = b^2 \text{ cos.}^2 x = b^2 (1 - \text{sin.}^2 x).$$

Reducing this equation, we obtain the following quadratic for sin. x:—

$$(a^2 + b^2) \text{ sin.}^2 x - 2ac \text{ sin. } x - (b^2 - c^2) = 0.$$

The solution of which is—

$$\text{Sin. } x = \frac{ac \pm b\sqrt{a^2 + b^2 - c^2}}{a^2 + b^2}.$$

Now assume that $\frac{b}{a} = \tan.\ \theta$, or $b = a \tan.\ \theta$, and substitute this in the above equation; then we obtain—

$$a\,(\sin.\ x + \cos.\ x \tan.\ \theta) = c.$$

Multiply each side by cos. θ, and—

$$a\,(\sin.\ x + \cos.\ \theta + \cos.\ x \sin.\ \theta) = c \cos.\ \theta;$$

$$\text{or,}\quad a \sin.\ (x + \theta) = c \cos.\ \theta.$$

From which we obtain the value of $x + \theta$, and ultimately of x, θ being already known from $\tan.\ \theta = \frac{b}{a}$.

XX. *Ratios between Sides and Angles of Plane Triangles in general.*—The solution of right-angled triangles was explained in Section X., and offered little difficulty. But for the solution of oblique-angled triangles more complex ratios have to be established between the sides and angles, which are contained in the following propositions and formulæ:—

1. *Any two sides of a plane triangle are in the same ratio as the sines of the opposite angles.*

For example, in any triangle A B C, $\frac{a}{b} = \frac{\sin.\ A}{\sin.\ B}$ (65)

Let A B C be the triangle (Figs. 12 and 13). From C drop C P perpendicular to A B, or, as in Fig. 13, to A B, produced either way;

Fig. 12.

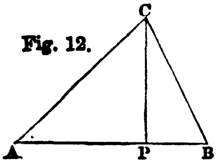
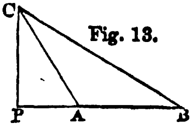


Fig. 13.



$$\text{then } \sin.\ A = \frac{CP}{AC}, \text{ and } \sin.\ B = \frac{CP}{CB};$$

$$\therefore \frac{\sin.\ A}{\sin.\ B} = \frac{\frac{CP}{AC}}{\frac{CP}{CB}} = \frac{CB}{AC} = \frac{a}{b}.$$

$$\text{Similarly,}\quad \frac{a}{c} = \frac{\sin.\ A}{\sin.\ C};\quad \frac{b}{c} = \frac{\sin.\ B}{\sin.\ C}.$$

If A or B be a right angle, there is no need to drop the perpendicular above referred to. The sine of the right angle will of course be unity, but the above reasoning will hold good, and the result be the same.

This statement of ratios between sides and sines of opposite angles is called *the rule of sines*, and may be thus written:—

$$\frac{\sin.\ A}{a} = \frac{\sin.\ B}{b} = \frac{\sin.\ C}{c} \quad \ldots\ldots\ldots\ (66)$$

2. *The sum of any two sides is to their difference as the tangent of half the sum of the opposite angles is to the tangent of half their difference.*

$$\text{By the last proposition,}\quad \frac{a}{b} = \frac{\sin.\ A}{\sin.\ B}.$$

Then, *componendo et dividendo*—

$$\frac{a + b}{a - b} = \frac{\sin.\ A + \sin.\ B}{\sin.\ A - \sin.\ B}.$$

$$\text{Whence by (47),}\quad \frac{a + b}{a - b} = \frac{\tan.\ \frac{1}{2}(A + B)}{\tan.\ \frac{1}{2}(A - B)} \quad (67)$$

This may be written differently; for $\frac{1}{2}(A + B) = \frac{1}{2}(180^\circ - C)$;

$$\therefore \tan.\ \tfrac{1}{2}(A + B) = \tan.\ (90^\circ - \tfrac{1}{2}C) = \cot.\ \tfrac{1}{2}C;$$

$$\left.\begin{aligned} &\therefore \frac{a + b}{a - b} \\ &= \frac{\cot.\ \frac{1}{2}C}{\tan.\ \frac{1}{2}(A - B)} = \cot.\ \tfrac{1}{2}(A - B) \cot.\ \tfrac{1}{2}C \\ &\text{Whence,}\quad \frac{a - b}{a + b} = \tan.\ \tfrac{1}{2}(A - B) \tan.\ \tfrac{1}{2}C \end{aligned}\right\} \quad (68)$$

3. *The sum of any two sides is to the third side as the cosine of half the difference of the opposite angles is to the cosine of half their sum.*

Since $A + B = 180^\circ - C$, $\sin.\ (A + B) = \sin.\ C$;

$$\therefore \frac{a}{c} = \frac{\sin.\ A}{\sin.\ (A + B)}, \text{ and } \frac{b}{c} = \frac{\sin.\ B}{\sin.\ (A + B)}.$$

Adding these equations, and using (41) and (60), we get—

$$\frac{a + b}{c} = \frac{\sin.\ A + \sin.\ B}{\sin.\ (A + B)}$$

$$= \frac{2 \sin.\ \frac{1}{2}(A + B) \cos.\ \frac{1}{2}(A - B)}{2 \sin.\ \frac{1}{2}(A + B) \cos.\ \frac{1}{2}(A + B)};$$

$$\therefore \frac{a + b}{c} = \frac{\cos.\ \frac{1}{2}(A - B)}{\cos.\ \frac{1}{2}(A + B)} \quad \ldots\ldots\ldots\ (69)$$

Similarly (by subtracting the second from the first equation above instead of adding them together) we find that

The difference of any two sides is to the third side as the sine of half the difference of the opposite angles is to the sine of half their sum;

$$\text{or}\quad \frac{a - b}{c} = \frac{\sin.\ \frac{1}{2}(A - B)}{\sin.\ \frac{1}{2}(A + B)} \quad \ldots\ldots\ldots\ (70)$$

4. *The square of any one side = the sum of the squares of the other sides less twice the rectangle contained by them multiplied into the cosine of the opposite angle* (*i.e.*, the angle included between the sides last mentioned).

If the opposite angle be a right angle, the "contained rectangle," being multiplied by cos. 90°, *i.e.*, by 0, disappears, and leaves only that part of the statement which concerns the squares of the sides, which is proved in Euclid I. 47.

If the opposite angle be acute (Fig. 12), by Euclid II. 13,

$$\mathrm{BC}^2 = \mathrm{AC}^2 + \mathrm{AB}^2 - 2\mathrm{AB} \cdot \mathrm{AP}.$$

$$\text{But since } \cos.\ \mathrm{A} = \frac{\mathrm{AP}}{\mathrm{AC}},\ \mathrm{AP} = \mathrm{AC} \cdot \cos.\ \mathrm{A};$$

$$\therefore\ \mathrm{BC}^2 = \mathrm{AC}^2 + \mathrm{AB}^2 - 2\mathrm{AB} \cdot \mathrm{AC} \cdot \cos.\ \mathrm{A};$$

or writing a, b, and c for BC, AC, and AB,

$$a^2 = b^2 + c^2 - 2bc \cos.\ \mathrm{A}.$$

If the opposite angle be obtuse (Fig. 13), by Euclid II. 12,

$$\mathrm{BC}^2 = \mathrm{AC}^2 + \mathrm{AB}^2 + 2\mathrm{AB} \cdot \mathrm{AP};$$

$$\text{but } \mathrm{AP} = \mathrm{AC} \cdot \cos.\ \mathrm{A} = \mathrm{AC} \cdot \cos.\ (180^\circ - \mathrm{A})$$

$$= -\mathrm{AC} \cdot \cos.\ \mathrm{A}\ (\mathrm{A} \text{ being in 2nd quadrant});$$

$$\left.\begin{aligned} \text{therefore, as before, } a^2 &= b^2 + c^2 - 2bc \cos.\ \mathrm{A} \\ \text{Similarly, } b^2 &= a^2 + c^2 - 2ac \cos.\ \mathrm{B} \\ \text{and, } c^2 &= a^2 + b^2 - 2ab \cos.\ \mathrm{C} \end{aligned}\right\} (71)$$

5. *Sines and cosines of angles in terms of sides.* From (71), by transposition,

$$\left.\begin{aligned} \mathrm{Cos.}\ \mathrm{A} &= \frac{b^2 + c^2 - a^2}{2bc} \\ \mathrm{Cos.}\ \mathrm{B} &= \frac{c^2 + a^2 - b^2}{2ac} \\ \mathrm{Cos.}\ \mathrm{C} &= \frac{a^2 + b^2 - c^2}{2ab} \end{aligned}\right\} \ldots\ldots\ldots\ldots (72)$$

$$\text{Since } \sin.^2 \mathrm{A} = 1 - \cos.^2 \mathrm{A},$$

$$\mathrm{Sin.}^2 \mathrm{A} = (1 + \cos.\ \mathrm{A})\ (1 - \cos.\ \mathrm{A})$$

$$= \left(1 + \frac{b^2 + c^2 - a^2}{2bc}\right) \left(1 - \frac{b^2 + c^2 - a^2}{2bc}\right)$$

$$= \left(\frac{2bc + b^2 + c^2 - a^2}{2bc}\right) \left(\frac{2bc - b^2 - c^2 + a^2}{2bc}\right)$$

$$= \left(\frac{(b^2 + 2bc + c^2) - a^2}{2bc}\right) \left(\frac{a^2 - (b^2 - 2bc + c^2)}{2bc}\right)$$

$$= \left(\frac{(b + c)^2 - a^2}{2bc}\right) \left(\frac{a^2 - (b - c)^2}{2bc}\right)$$

$$= \frac{(a + b + c)\ (b + c - a)\ (a + b - c)\ (a + c - b)}{4b^2c^2}.$$

This expression for sin.² A (and therefore sin. A by extracting the root) is in better form for calculation than (72), as it consists entirely of factors. It can, however, be further simplified by taking

$$s = \textit{semiperimeter} \text{ of triangle};$$

$$\begin{aligned} \text{then } 2s &= a + b + c, \\ \text{and } 2(s - a) &= b + c - a, \\ 2(s - b) &= a + c - b, \\ 2(s - c) &= a + b - c; \end{aligned}$$

therefore, extracting the root, and simplifying,

$$\sin.\ \mathrm{A} = \frac{2\sqrt{s(s - a)\ (s - b)\ (s - c)}}{bc} \ldots (73)$$

The expressions for sin. B and sin. C are alike, but the denominator is ac in the one case and ab in the other.

6. *Sines, cosines, and tangents of the semi-angles.*

$$\text{By (62),}\quad 1 + \cos.\ \mathrm{A} = 2 \cos.^2 \tfrac{1}{2} \mathrm{A}.$$

But by the preceding calculations,

$$1 + \cos.\ \mathrm{A} = \frac{4s\ (s - a)}{2bc};$$

$$\therefore\ 2 \cos.^2 \tfrac{1}{2} \mathrm{A} = \frac{2s\ (s - a)}{bc};$$

$$\left.\begin{aligned} \therefore\ \cos.\ \tfrac{1}{2} \mathrm{A} &= \sqrt{\frac{s\ (s - a)}{bc}} \\ \text{Similarly, } \cos.\ \tfrac{1}{2} \mathrm{B} &= \sqrt{\frac{s\ (s - b)}{ac}} \\ \text{and}\quad \cos.\ \tfrac{1}{2} \mathrm{C} &= \sqrt{\frac{s\ (s - c)}{ab}} \end{aligned}\right\} \ldots (74)$$

Deducing in a similar manner from other values of 1 – cos. A, etc, we get expressions for the sines of the semi-angles, and by dividing the latter by the corresponding expressions for the cosines (74), we get the tangents, as under—

$$\left.\begin{aligned} \mathrm{Sin.}\ \tfrac{1}{2} \mathrm{A} &= \sqrt{\frac{(s - b)\ (s - c)}{bc}} \\ \mathrm{Sin.}\ \tfrac{1}{2} \mathrm{B} &= \sqrt{\frac{(s - a)\ (s - c)}{ac}} \\ \mathrm{Sin.}\ \tfrac{1}{2} \mathrm{C} &= \sqrt{\frac{(s - a)\ (s - b)}{ab}} \end{aligned}\right\} \ldots\ldots (75)$$

$$\left.\begin{aligned} \mathrm{Tan.}\ \tfrac{1}{2} \mathrm{A} &= \sqrt{\frac{(s - b)\ (s - c)}{s\ (s - a)}} \\ \mathrm{Tan.}\ \tfrac{1}{2} \mathrm{B} &= \sqrt{\frac{(s - a)\ (s - c)}{s\ (s - b)}} \\ \mathrm{Tan.}\ \tfrac{1}{2} \mathrm{C} &= \sqrt{\frac{(s - a)\ (s - b)}{s\ (s - c)}} \end{aligned}\right\} \ldots\ldots (76)$$

If one of each set be remembered, the other two formulæ can be brought to mind at once in all these cases, owing to the symmetry and obviousness of the system on which the formulæ are constructed.

KEY TO EXERCISES.

(No Key is required to Exercise 3.)

ELECTRICITY.—X.

[Continued from Vol. V., p. 376.]

MEASUREMENT OF SMALL RESISTANCES—FOSTER'S METHOD—MEASUREMENT OF HIGH RESISTANCES—METHOD OF DIRECT COMPARISON—LOSS OF CHARGE METHOD.

For the measurement of resistances of ordinary dimensions there is no better method than by the Wheatstone Bridge; it is simple, expeditious, and, within its range, accurate. Its range, though large, is by no means as large as might be desired. The highest resistance it can measure is one megohm (one million ohms), whereas in dealing with insulation resistances it is necessary to measure thousands, and sometimes hundreds of thousands of megohms. On the other hand, the smallest resistance that can be measured by the bridge is ·01 ohm, and it often becomes necessary to make measurements far closer than that. One of the most frequent cases that arises is, to compare two resistances which are supposed to be equal. The best method for making the desired comparison is due to Foster, and is generally known as "Foster's method."

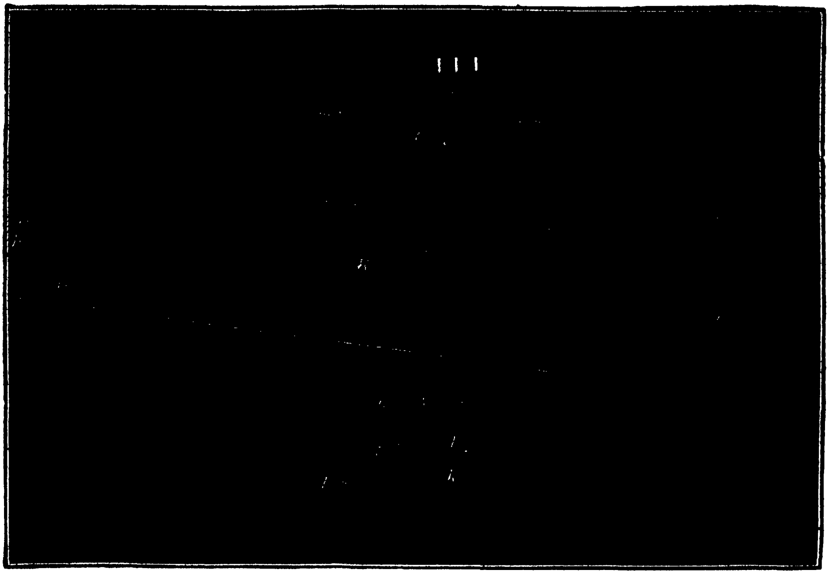


Fig. 55.—The Metre Bridge.

In this method the Metre Bridge is employed—a piece of apparatus which is illustrated in Fig. 55. It consists of a wooden base, upon the upper face of which is mounted a metallic rectangle; three sides of this rectangle are formed by a broad substantial copper band—having a negligible resistance—and the fourth consists of a platinum silver wire *w w* joining the copper blocks P and *p*. This wire is exactly one metre long, and over it slides a key K, which when depressed makes contact by means of a platinum knife-edge with the wire; the exact point on the wire at which this contact is made is indicated by an arrow-head on the key, which slides against a scale, as shown. The scale is placed inside the metallic rectangle, and is carefully divided into millimetres. In the usual form of the metre bridge the fourth side of the rectangle consists of a single wire, but in the bridge illustrated in Fig. 55 three wires are used in order to give a greater degree of sensitiveness. Either one, two, or three of these wires can be used, according to the position of the plug E. In the position of the plug here shown—inserted in the hole H—the single wire *w w* is used; when inserted in the hole *h*, the two outside wires are placed in series, and if the plug is not placed in either hole, then the three wires are placed in series.

The details of construction of the key are shown on a larger scale on the lower part of the figure. It consists of a light brass frame carrying two terminals, to which wires can be attached; on A A as an axis is pivoted a light lever L L, which carries the knife-edge *k*, and which is kept pressed up by means of a spring. K is an ebonite button upon which the finger is placed when it is desired to depress the key. S is a light spring attached to the knife-edge, and which can fit into any one of three grooves in the lever L L: by moving this spring into the proper groove the knife-edge can be made to make contact with any of the three wires.

On the side of the rectangle opposite to the wire the copper band is broken at four places, and terminals are fixed at suitable points as shown. In Fig. 55 two of these gaps are not in use, and are consequently bridged over by two substantial pieces of copper, S_1 and S_2. The metre bridge can be used for measuring resistances of the ordinary kind, and for this purpose the connections used are those shown in Fig. 55. That marked *unknown* is the resistance to be measured, and that marked *known* is a box containing a set of known resistances.

The battery and galvanometer are joined up as shown. In making a measurement the key is moved over the wire till a point is reached which will give "balance."

Then

$$\text{Unknown resistance} = \frac{l_1}{l_2}\text{known},$$

where

l_1 = length of the wire from P to the point of balance

l_2 = ” ” *p* ” ”

The longer the wire is made, the more accurate will be the test, and a still further improvement can be made by inserting known resistances in the gaps S_1 and S_2.

It will be noticed that the accuracy of this method of testing a resistance entirely depends upon the lengths l_1 and l_2 being proportional to the resistances of those portions of the wire; in other words, the resistance of the wire must be perfectly uniform throughout its entire length in order that this method of testing shall be accurate. In the case of a new bridge it may be usually assumed that, with the exception of those portions of the wire quite close to the ends, the wire is of uniform resistance throughout its length. When the bridge has been in use for some considerable time the constant depressing of the knife-edge on the wire wears away the upper surface of the latter, and as this wearing away does not occur uniformly over the length of the wire, but occurs principally about the central portion, it is clear that such a bridge is not to be relied upon for giving good results.

In order to compare two resistances by "Foster's method," the connections to be made are those shown in Fig. 56.

The battery and galvanometer are joined up as in the previous case.

A and B are two resistances which must be nearly equal, but whose absolute values it is not necessary to know; they may be conveniently made of two pieces of German-silver wire of about the same length.

S is a standard resistance whose value we know to a sufficient degree of accuracy.

X is the unknown resistance which it is required to compare with the standard S.

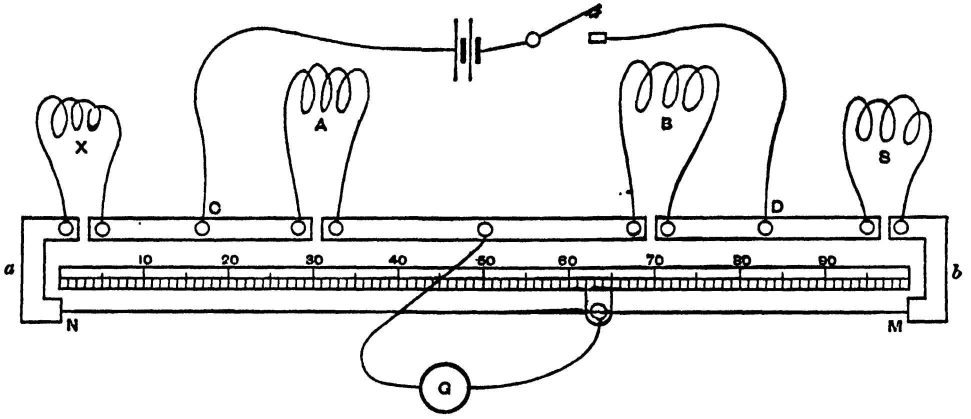


Fig. 56.—Connections for Foster's Method.

Let μ = the resistance of one centimetre of the wire. Then two observations must be made as follows:—

Observation (1).—With above connections adjust the position of the key K till balance is obtained. Let the distance of the key from N be x centimetres.

Now interchange the positions of X and S.

Observation (2).—With X and S in their new positions again adjust the position of K till balance is obtained. Let the new position of balance be at a distance of x_1 centimetres from the point N.

Then from these two observations we obtain the following formula—

$$X - S = \mu\,(x_1 - x),$$

which means that *the difference between the resistances of* X *and* S *is equal to the resistance of that portion of the wire on the bridge which lies between the two points of balance.*

In doing this test practically, it is not advisable to connect the resistances X and S to the bridge by means of binding screws, as there might be some slight differences introduced into the contacts when the coils were interchanged, between the two observations. The best plan to adopt is to use little reservoirs of mercury into which the ends of the resistances, and the wires from the bridge, can be made to dip. When the resistances X and S are then interchanged, the resistances of the contacts remain practically the same. The reservoirs can be conveniently made by cutting holes of the necessary size in blocks of paraffin-wax. The great advantage of this test over all others lies in the fact that the resistances of all contacts, except those between the mercury and the coils—which are negligible—as well as the resistance of the copper band—are eliminated.

The truth of the above formula can be verified by simplifying the following two equations which apply to the conditions of things when the two tests are made:—

For Observation (1)—

$$\frac{X + a + \mu r}{S + b + \mu (l-x)} = \frac{A}{B};$$

for Observation (2)—

$$\frac{S + a + \mu r_1}{X + b + \mu (l-x_1)} = \frac{A}{B};$$

where

l = length of wire in centimetres,
a = resistance of all contacts between N and C,
b = „ „ „ M and D.

If the wire on the bridge is not of uniform resistance it must be calibrated; that is to say, we must know the resistance of each centimetre of it. As the resistance of a centimetre of such a wire is seldom as great as ·005 ohm, and is usually about half this value, and as it is easy to obtain a balance by subdividing a millimetre into quarters, it is clear that the difference between the values of X and S can be obtained accurately to the ·0001 part of an ohm. The most probable source of errors in making such a test is due to heating effects caused either by the operator, or the lamp used in connection with the galvanometer. This is a most suitable method for comparing reputed ohms with a standard.

MEASUREMENT OF HIGH RESISTANCES.

The highest resistance that can be measured by the ordinary Wheatstone Bridge is 1,000,000 ohms, which is much smaller than many ordinary insulation resistances. Such resistances must of necessity be measured by some other method, and the one most commonly adopted is that known as the "direct comparison." The connections for this method are shown in Fig. 57.

The battery usually consists of a large number of cells; 100 Leclanchés are often used. G is a reflecting galvanometer, with the adjustable shunt S attached. R is a very high resistance of known value—it is usually a megohm.

OBSERVATION (1).—With these connections the key is depressed, and a current sent round the circuit as indicated. The shunt on the galvanometer is now adjusted till a convenient deflection is obtained.

The known resistance R is now removed, and the unkown one—let it be X—inserted in its place.

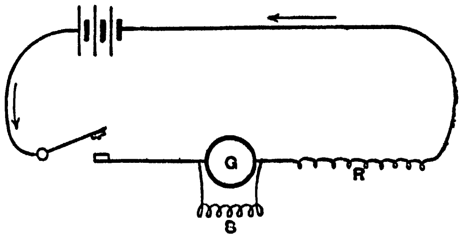


Fig. 57.

OBSERVATION (2).—The key is again depressed, and the shunt adjusted till a convenient deflection is obtained.

Then the value of X is given by the equation

$$X = R \frac{D_1 \frac{G + S_1}{S_1}}{D_2 \frac{G + S_2}{S_2}},$$

where D_1 = deflection obtained in Observation (1),
„ D_2 = „ „ „ (2),
„ S_1 = shunt used in Observation (1),
„ S_2 = „ „ „ (2),
„ G = resistance of galvanometer.

When measuring the resistance of many of the most common insulating substances, such as gutta-percha, india-rubber, etc., it will be noticed that in Observation (2) the deflection on the galvanometer will decrease fairly quickly in the beginning, and more slowly as time goes on; this means that the resistance of the substance increases fairly quickly when the current is first sent through it, and continues to increase, but more and more slowly as time goes on. This phenomenon is usually known as *electrification*, and is common to many high resistance substances. This phenomenon of electrification is clearly shown by the following figures, which are taken at random from a series of tests made by the writer on a section of a gutta-percha covered cable, which now spans the Atlantic.

RESISTANCE PER KNOT IN MEGOHMS AT A TEMPERATURE OF 75° F., USING 300 LECLANCHÉ CELLS.

Resistance at the end of the		1st	minute	679	megohms.
„	„	2nd	„	718	„
„	„	3rd	„	742	„
„	„	5th	„	762	„
„	„	7th	„	778	„
„	„	10th	„	795	„

Another peculiarity in connection with this phenomenon of electrification is that if, at the end of a certain time, the direction of the current be reversed, the deflection will immediately become higher than any of its previous values; but, on keeping the current on, it will become smaller and smaller as in the previous case. This means that on reversing the current the resistance of the material apparently falls, but gradually rises again when the current is kept on for a sufficiently long time. The following is a table showing the resistance per knot in megohms, at a temperature of 75° F., of the same cable as in the previous test, but in this case the current was reversed at the end of every three minutes.

CABLE TEST SHOWING EFFECT OF REVERSALS.

Pole of Battery to Line.	Resistance at the End of 1st Minute.	Resistance at the End of 2nd Minute.	Resistance at the End of 3rd Minute.
–	672 megohms.	716 megohms.	755 megohms
+	599 ,,	650 ,,	716 ,,
–	610 ,,	664 ,,	729 ,,
+	622 ,,	670 ,,	731 ,,
–	622 ,,	672 ,,	732 ,,
+	634 ,,	681 ,,	742 ,,

It will be noticed that in both these tests the temperature is stated as being 75° F. This does not mean that the tests were actually made at that temperature, but that the tests were made at a known temperature, and then by means of known constants were reduced to a temperature of 75° F., which is the recognised standard temperature for insulating materials in cable-work. The necessity for reducing all insulating resistances to a common standard temperature becomes at once obvious when we realise how enormously the resistances of these materials vary by the change of even a few degrees in temperature. Unlike the metals and good conductors, their resistances *decrease* with an increase of temperature.

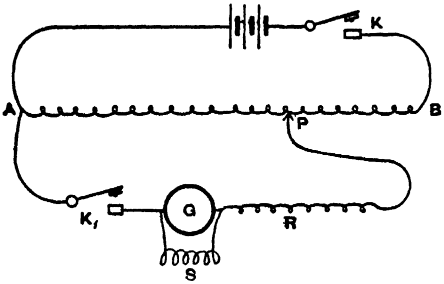


Fig 58.

In the test above described the battery-power was kept constant for both observations. It often becomes convenient to vary the battery-power instead of the shunt, or to vary both. In order to do this, the connections shown in Fig. 58 should be used.

In Fig. 58 A B is a high resistance through which the current from the battery flows when the key K is depressed. The E.M.F. working between the points A and B is a fixed quantity, and is not sensibly altered by depressing the key K_1. The E.M.F. working through the galvanometer and R, clearly depends upon the position on A B, at which P is attached. The nearer P is to A, the smaller will be the E.M.F.; in fact, the E.M.F. is proportional to the resistance between the points A and P, and is that fraction of the whole E.M.F. that A P is of A B.

The two observations are made as in the previous test, but the position of the point P is varied so as to produce convenient deflections.

Then, using the same symbols as before—

$$X = R \frac{E_2 \times D_1 \frac{G + S_1}{S_1}}{E_1 \times D_2 \frac{G + S_2}{S_2}}.$$

Where E_1 = the E.M.F. used in Observation (1),
,, E_2 = ,, ,, ,, (2).

These E.M.F.'s are, of course, unknown quantities, but as they are proportional to the resistances between A and P, we can substitute these resistances for them.

When the galvanometer is only provided with three shunts—as is usually the case—this modified method is often extremely useful.

In tests of this description the galvanometer should always be short-circuited when the key is depressed, otherwise it may be broken by the sudden momentary rush of current which takes place when the resistance under test has a large capacity.

LOSS OF CHARGE METHOD.

In carrying out this test, the quadrant electrometer is used. The principle of this instrument has not yet been explained, but it will be dealt with in a following chapter; for the present, it is sufficient to know that it is an instrument having the general external appearance of a reflecting galvanometer, but which, instead of measuring the strength of a current as a galvanometer does, measures the potential of any body with which it is in contact.

The connections for making the test are shown in Fig. 59.

X is the resistance which is to be measured, and which, in the case of a cable, has a definite capacity. If it has no capacity, or, rather, if its capacity is so small as to be inappreciable, a condenser of known capacity must be placed in parallel with it.

E is the electrometer.

K is a double-current key, which is constructed as follows:—*c* and *d* are two substantial brass bars rigidly fixed, and each carrying a terminal at one end; one of these, *c*, is fixed at a somewhat higher level than the other. *a* and *b* are springy brass bars fixed at their upper ends, and resting against the under surface of the bar *c*, with which they both make good contact. Either or both of these bars can be pressed down at will, so as to break contact with the upper bar, *c*, and to make contact with the lower bar, *d*.

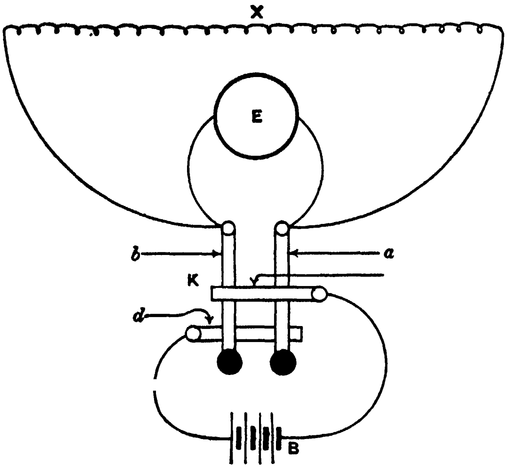


Fig. 59.—Loss of Charge Method.

The *battery is always attached to the two fixed bars*, as shown; and it will then be seen that when thus connected up, it cannot be short-circuited by the key—this statement applies to all situations where a battery is connected to a double current key. If *a* and *b* are both up, as shown in Fig. 59, no current can flow; if they are both pressed down, no current can flow; if *b* is up and *a* pressed down, then a current will flow through X from right to left; and if *a* is up and *b* down, a current will flow through X from left to right. We thus see that a current can be sent through the circuit in either direction, according to the arm of the key that we depress. These keys are often provided with cams, by means of which either or both arms can be held in intermediate positions without making contact with either bar; for electrometer work these cams become a necessity. A word of warning on the subject of these cams will not be out of place here, more especially as it deals with a point not generally recognised, even by those accustomed to work with electrometers. The cams are usually made of ebonite discs pivoted excentrically, and, in order to bring an arm of the key into an intermediate position, one of them is rotated till the arm is pressed down by the desired amount. This rotation of the ebonite cam in contact with the brass bar is quite sufficient to generate a static charge, which will greatly affect the readings of the electrometer; in fact, for any kind of delicate work the results obtained may be inconsistent, or entirely misleading. The substitution of brass for ebonite in the cams would introduce no evil effects, and would eliminate the source of error here pointed out.

Returning to the "Loss of Charge" test, the following observations must be made:—

Observation (1).—Depress one arm of the key, and thus charge both the electrometer and the resistance, X. The electrometer will now show a certain deflection, which is a measure of the potential to which the resistance has been charged.

Observation (2).—Allow the arm of the key to rise to an intermediate position, and maintain it in this position by means of the cam. Take readings of the electrometer's deflection at the end of convenient intervals of time—say thirty seconds—and continue these observations for a few minutes, or longer if necessary.

From the moment of insulating the arm of the key the resistance, X, is no longer being charged by the battery, and as its original charge gradually leaks through, its potential falls at the same rate; and, as the deflection on the electrometer is an index of the potential, it therefore is an index of the rate at which loss of charge takes place through the resistance, X. If the resistance, X, is very great, the deflection will fall extremely slowly, and it may be sufficient to take readings at the end of every one or two minutes, but when X is small, the deflection falls rapidly, and readings at the end of every ten or fifteen seconds may become necessary.

From these readings the resistance of X can be calculated by Siemen's formula, which is as follows:—

$$X = \frac{T}{2{\cdot}303\ F\ \log.\frac{D}{d}}$$

where X = the resistance in megohms;
„ F = the capacity in microfarads of the resistance X, or the capacity of the condenser in parallel with it;
„ D = deflection when battery is on;
„ *d* = deflection at the end of T seconds;
„ T = time in seconds between observations for D and *d*.

The quadrant electrometer is certainly a delicate instrument, but, at the same time, with ordinary care, it is thoroughly trustworthy.

LATIN.—XXXI.

[*Continued from Vol. V., p. 329.*]

THE AGRICOLA OF TACITUS (*continued*).

Military Service in Britain.

5. Prima castrorum rudimenta in Britannia Suetonio Paulino, diligenti ac moderato duci, adprobavit, electus quem contubernio aestimaret. Nec Agricola licenter, more juvenum, qui militiam in lasciviam vertunt, neque segniter ad volupates et commeatus titulum tribunatus et inscitiam rettulit: sed noscere provinciam, nosci exercitui, discere a peritis, sequi optimos, nihil adpetere in jactationem, nihil ob formidinem recusare simulque et anxius et intentus agere. Non sane alias excitatior magisque in ambiguo Britannia fuit: trucidati veterani, incensae coloniae, intercepti exercitus; tum de salute, mox de victoria certavere. Quae cuncta etsi consiliis ductuque alterius agebantur, ac summa rerum et reciperatae provinciae gloria in ducem cessit, artem et usum et stimulos addidere juveni, intravitque animum militaris gloriae cupido, ingrata temporibus, quibus sinistra erga eminentes interpretatio nec minus periculum ex magna fama quam ex mala.

6. Hinc ad capessendos magistratus in urbem digressus Domitiam Decidianam, splendidis natalibus ortam, sibi junxit; idque matrimonium ad maiora nitenti decus ac robur fuit. Vixeruntque mira concordia, per mutuam caritatem et in vicem se anteponendo, nisi quod in bona uxore tanto maior laus, quanto in mala plus culpae est. Sors quaesturae provinciam Asiam, pro consule Salvium Titianum dedit, quorum neutro corruptus est, quamquam et provincia dives ac parata peccantibus, et pro consule in omnem aviditatem pronus quantalibet facilitate redempturus esset mutuam dissimulationem mali. Auctus est ibi filia, in subsidium simul et solacium; nam filium ante sublatum brevi amisit. Mox inter quaesturam ac tribunatum plebis atque ipsum etiam tribunatus annum quiete et otio transiit, gnarus sub Nerone temporum, quibus inertia pro sapientia fuit. Idem praeturae tenor et silentium; nec enim jurisdictio obvenerat. Ludos et inania honoris medio rationis atque abundantiae duxit, uti longe a luxuria, ita famae propior. Tum electus a Galba ad dona templorum recognoscenda, diligentissima conquisitione effecit, ne cujus alterius sacrilegium res publica quam Neronis sensisset.

7. Sequens annus gravi vulnere animum domumque eius adflixit. Nam classis Othoniana licenter vaga dum Intimilium (Liguriae pars est) hostiliter populatur, matrem Agricolae in praediis suis interfecit, praediaque ipsa et magnam patrimonii partem diripuit, quae causa caedis fuerat. Igitur ad sollemnia pietatis profectus Agricola, nuntio adfectati a Vespasiano imperii deprehensus ac statim in partes transgressus est. Initia principatus ac statum urbis Mucianus regebat, juvene admodum Domitiano et ex paterna fortuna tantum licentiam usurpante. Is missum ad dilectus agendos Agricolam integreque ac strenue versatum vicensimae legioni tarde ad sacramentum transgressae praeposuit, ubi decessor seditiose agere narrabatur: quippe legatis quoque consularibus nimia ac formidolosa erat, nec legatus praetorius ad cohibendum potens, incertum suo an militum ingenio. Ita successor simul et ultor electus rarissima moderatione maluit videri invenisse bonos quam fecisse.

Agricola's Career in Britain.

8. Praeerat tunc Britanniae Vettius Bolanus, placidius quam feroci provincia dignum est. Temperavit Agricola vim suam, ardoremque compescuit, ne incresceret, peritus obsequi eruditusque utilia honestis miscere. Brevi deinde Britannia consularem Petilium Cerialem accepit. Habuerunt virtutes spatium exemplorum. Sed primo Cerialis labores modo et discrimina, mox et gloriam communicabat: saepe parti exercitus in experimentum, aliquando maioribus copiis ex eventu praefecit. Nec Agricola umquam in suam famam gestis exsultavit; ad auctorem ac ducem ut minister fortunam referebat. Ita virtute in obsequendo, verecundia in praedicando extra invidiam nec extra gloriam erat.

He becomes Governor of Aquitania, holds the Consulship, and is then appointed Governor of Britain.

9. Revertentem ab legatione legionis divus Vespasianus inter patricios adscivit; ac deinde provinciae Aquitaniae praeposuit, splendidae inprimis dignitatis administratione ac spe consulatus, cui destinarat. Credunt plerique militaribus ingeniis subtilitatem deesse, quia castrensis jurisdictio secura et obtusior ac plura manu agens calliditatem fori non exerceat. Agricola naturali prudentia, quamvis inter togatos, facile justeque agebat. Jam vero tempora curarum remissionumque divisa. Ubi conventus ac judicia poscerent, gravis, intentus severus, et saepius misericors: ubi officio satis factum, nulla ultra potestatis persona. Tristitiam et adrogantiam et avaritiam exuerat. Nec illi, quod est rarissimum, aut facilitas auctoritatem aut severitas amorem deminuit. Integritatem atque abstinentiam in tanto viro referre injuria virtutum fuerit. Ne famam quidem, cui saepe etiam boni indulgent, ostentanda virtute aut per artem quaesivit. Procul ab aemulatione adversus collegas, procul a contentione adversus procuratores et sincere inglorium et atteri sordidum arbitrabatur. Minus triennium in ea legatione detentus ac statim ad

spem consulatus revocatus est, comitante opinione Britanniam ei provinciam dari, nullis in hoc suis sermonibus, sed quia par videbatur. Haud semper errat fama; aliquando et elegit. Consul egregiae tum spei filiam juveni mihi despondit ac post consulatum collocavit, et statim Britanniae praepositus est, adjecto pontificatus sacerdotio.

The Geography of Britain.

10. Britanniae situm populosque multis scriptoribus memoratos non in comparationem curae ingeniive referam, sed quia tum primum perdomita est. Ita quae priores nondum comperta eloquentia percoluere, rerum fide tradentur. Britannia, insularum quas Romana notitia complectitur maxima, spatio ac caelo in orientem Germaniae, in occidentem Hispaniae obtenditur, Gallis in meridiem etiam inspicitur; septentrionalia ejus, nullis contra terris, vasto atque aperto mari pulsantur. Formam totius Britanniae Livius veterum, Fabius Rusticus recentium eloquentissimi auctores oblongae scutulae vel bipenni adsimulavere. Et est ea facies citra Caledoniam, unde et in universum fama est transgressa. Sed immensum et enorme spatium procurrentium extremo jam litore terrarum velut in cuneum tenuatur. Hanc oram novissimi maris tunc primum Romana classis circumvecta insulam esse Britanniam adfirmavit, ac simul incognitas ad id tempus insulas, quas Orcadas vocant, invenit domuitque. Dispecta est et Thule, quia hactenus jussum: et hiems adpetebat. Sed mare pigrum et grave remigantibus perhibent ne ventis quidem perinde attolli; credo quod rariores terrae montesque, causa ac materia tempestatum, et profunda moles continui maris tardius impellitur. Naturam Oceani atque aestus neque quaerere hujus operis est, ac multi rettulere. Unum addiderim nusquam latius dominari mare, multum fluminum huc atque illuc ferre, nec litore tenus adcrescere aut resorberi, sed influere penitus atque ambire, et jugis etiam ac montibus inseri velut in suo.

NOTES TO TACITUS.

Chap. V.—*Adprobavit* = "Served with the approval of."

Electus, quem contubernio aestimaret. Literally translated these words mean, "being chosen, that by constant companionship, he might judge his character." In English the sentence must be turned round, and *electus* changed from active to passive: "Who chose him (Agricola) to be his comrade, that he might judge his character."

Nec . . . titulum . . . rettulit. "He did not use his rank for the purpose of," or "he did not take advantage of his rank to."

Ad jactationem = "in order to produce an effect."

Alias, "at any other time."

Tum . . . mox. Note the contrast, "*then* it was a struggle for existence, *soon after* it was a struggle for mastery."

In ducem cessit, "fell to the lot of."

Temporibus, personified, "regarded with disfavour by an age in which," etc.

Chap. VI.—*Hinc*, local, "from hence."

Ad capessendos magistratus. The Roman citizen who took any part in public life had to go through a regular succession of offices. After seeing some military service (as Agricola had done), it was necessary for a man to go through the different stages of the civil career, the quæstorship, the tribunate, and the prætorship; and it was only after holding these offices that a man was eligible for the highest magistracy of all, the consulship. For the duties of these offices we must refer you to your Roman history, or any good Dictionary of Antiquities.

Splendidis natalibus ortam, "a lady of distinguished lineage."

In vicem se anteponendo, "by preferring each other to themselves"; *i.e.*, by mutual self-sacrifice.

Nisi quod (= except that) must not be translated literally. It introduces a qualification = "however."

Sors quaesturae. There were twenty quæstors to whom various duties were assigned. The distribution of the particular offices was decided by lot.

Pro consule = (lit.) "in place of a consul." Certain magistrates who had the powers and duties of consuls or prætors, while not actually holding the office, were called *pro consule, pro praetore.* The phrase came to be used as an official title, and might be used with any case (here with an accusative, below with a subst.).

Neutro, sc., neither by the fact that Asia (which gave great opportunities for corruption) was his province, nor by the fact that Salvius (who was himself corrupt) was his superior officer.

Mutuam dissimulationem, "a reciprocal concealment."

Filia. This was the daughter afterwards married to Tacitus.

Sublatum, lit., "raised up" = "born." When a child was born, the father acknowledged it and announced his intention of rearing it by formally lifting it up (*tollere*).

Inter quaesturam et tribunatum = "(the time) between," etc., governed by *transiit.*

Gnarus sub Nerone temporum, *i.e.*, he knew the dangers of the times under Nero.

Jurisdictio obvenerat, "the office of (civil) jurisdiction had not fallen to his lot." Of twelve prætors two (chosen by lot) had the most important duty of controlling judicial proceedings in all private cases.

Ludos et inania honoris, "the games and the vain display of the office." The prætors had to superintend the public games, and usually sought popularity by presenting them on a magnificent scale.

A Galba. Nero was overthrown, and killed himself in A.D. 68. A year of confusion followed; Galba succeeded Nero as emperor, but was overthrown by Otho in 69 A.D.; Otho was conquered by Vitellius, who in the same year was defeated and killed by the forces of Vespasian. Vespasian then became emperor, and reigned for some years.

Ne cujus, etc.; *i.e.*, the only loss which could not be recovered was that caused by Nero's sacrilege.

Chap. VII.—*Licenter*, with *vaga*, "while cruising for plunder" (lit., "lawlessly").

Ad sollemnia pietatis, "to perform the duties of filial feeling."

Nuntio . . . deprehensus, "overtaken by the news that Vespasian had assumed the empire."

Initia principatus. In English we should express this idea passively. "The first steps of his reign and the government of the city were ordered by Mucianus." Mucianus was the lieutenant of Vespasian.

Mucianus. Tacitus explains the employment of Mucianus (in the absence of Vespasian himself and his eldest son, Titus, in the East) by saying that Domitian (the younger son of Vespasian) was too young to do anything except to find opportunity for his excesses from his father's advancement.

Is = Mucianus.

Tarde ad sacramentum transgressae, "that had been tardy in taking the oath" (of allegiance to the new Emperor).

Decessor, "the retiring officer, his predecessor"—Roscius Cœlius.

Legatis consularibus. Legates of consular rank were set over provinces, and held the most important office of any magistrates under the Empire. Each legion was governed by a *legatus praetorius*, and Tacitus says that this legion was too violent (*nimia*) even for consular legates, much less could a prætorian control it.

Incertum . . . ingenio. Tacitus is fond of leaving a question open in this way, giving a hint of unworthy motives without deciding for or against.

Successor simul . . . electus. "Chosen at once to succeed (Roscius) and to punish (the disaffected)."

Chap. VIII.—The first sentence in this chapter is a good example of Tacitean compression. In English a relative clause is necessary to render the full meaning: Britain was then under the rule of Vettius Bolanus, who governed more mildly than befitted so high-spirited a province.

Feroci. Ferox must never be translated "*ferocious*," which has a restricted meaning in English. *High-spirited* or *rebellious* gives the sense of the Latin word.

Est. This has troubled the commentators. *Esset* or *erat* would suit the sentence better. But if we regard the statement as still holding good at the time when Tacitus wrote, the present tense is easily explained.

Accepit. "Received as its governor."

Virtutes. "Agricola's worth."

Communicabat. "Shared," *i.e.*, with Agricola.

Ex eventu. "From the result of the experiment."

Chap. IX.—*Revertentem.* The present participle should here be rendered "while he was on his way back."

Divus. This was the epithet always applied to deceased Roman Emperors. They were awarded divine honours on their death. In translating it may be omitted altogether or rendered by "late."

Splendidae dignitatis. This is a genitive of quality. In English we should express it by a noun in apposition, thus: "He was made governor of the province of Aquitania, *a brilliant appointment.*"

Destinarat. The subject of this verb is Vespasianus.

Secura Messrs. Church and Brodripp translate this by "summary," which gives the precise meaning It implies that which does not involve care and consideration.

Calliditatem. "Shrewdness." The Latin word, as the English, suggests "smartness" pushed too far to be honourable.

Togatos. "Civilians" as opposed to soldiers. The hackneyed quotation *cedant arma togae* is an apt illustration of the meaning which *togati* bears in the present passage.

Divisa. The auxiliary verb is here omitted. This omission of the auxiliary, as of the copula, is characteristic of the style of Tacitus, and you will note its frequent occurrence in the present chapter. You may find it at first a little puzzling, but the difficulty will disappear when you are once on your guard.

Conventus. "The assizes."

Persona. This word literally means a *mask;* whence it derives the signification of *part* or *character*. Translate, "he no longer wore the mask of power." In *exuerat* the metaphor is still preserved: "he had put off."

Integritatem . . . referre. These words and all between form the subject of *fuerit*.

Cui saepe etiam boni indulgent. "To which even good men often give way."

Procul ab aemulatione. In English, as in Latin of the sternly classical period, we should here have an adjective instead of an adverb.

Atteri. "To be worsted."

Dari. Note the force of the present infinitive. It implies that the province of Britain was not already given him, but that it was offered him.

Par. "Equal to the responsibility."

Despondit . . . collocavit. These words have a strict significance. The former means "betrothed," the latter, "gave in marriage."

Chap. X.—This and the following chapters contain a most interesting and valuable account of Britain, as it appeared to a Roman of the first century after Christ.

Multis scriptoribus. Before the time of Tacitus, Cæsar, Livy, and the elder Pliny (among others) had written descriptions of Britain.

Non in comparationem. "Not to pit my accuracy and intelligence against theirs."

Romana notitia. "Roman knowledge," *i.e.*, of geography.

Spatio ac caelo. "In extent and position." A comparison of this description with a map will demonstrate that Tacitus was not quite accurate.

Scutulae. This fanciful description of the shape of Britain is a little obscure. A *scutula* is a mathematical figure, which we call a rhomboid. If Scotland is left out of consideration, as Tacitus says, then England is not altogether unlike an irregular four-sided figure. The comparison to a battle-axe is intelligible if we leave out the handle and only consider the head.

Sed immensum, etc. This is an easily recognisable description of Scotland, which tapers off towards the north into the shape of a wedge.

Orcadas. The group of islands known as the Orkneys.

Thule. This is evidently not Iceland, and may be Mainland, the largest of the Shetlands.

Dispecta est et Thule. This sentence presents some difficulty, and the words *quia hactenus jussum* are as good an example of compression as may be found. The emphatic word of the sentence is *dispecta*, and the force of it may thus be rendered: "Thule was only seen from afar, as the order was to sail so far and no further, as winter was approaching."

Nusquam latius, etc. "The sea has nowhere a wider sway."

Multum fluminum. "It has many currents running in all directions." *Fluminum* is a partitive genitive dependent on *multum*. The *flumina* here spoken of are not rivers, but currents of the sea."

Nec litore . . . . in suo. It would be impossible to find a more graphic description than these words give of the friths of Scotland, or the fiords of Norway.

KEY TO TACITUS. (Vol. V., p. 827.)

1. Amongst the ancients it was common to transmit to posterity the characters and exploits of memorable men; nor in truth in our own times has the age, however indifferent about what concerns itself, failed to observe the like usage

whenever any spirit eminent for great and signal virtue has vanquished, and triumphed over, the vice, common to great states and to small, ignorance of right and malice. But, as in those early times there was found greater propensity to feats of renown, and more scope to perform them, so the man of the highest talent was naturally led merely by the reward of a good conscience to hand down the merits and memory of the virtuous dead without favour or self-seeking. Many, indeed, in recounting their own lives, thought that they showed confidence in their own character rather than arrogance. Neither was the account which Rutilius and Scaurus gave of themselves thence the less credited or the more censured. So true it is that when virtues are most prized, they are most easily produced. But for myself, who am going to relate the life of a man already dead, pardon is necessary; which I should not have asked, had I not been going to attack times so sanguinary, and baneful to all virtue.

2. We find it recorded, that for celebrating the praises o Pætus Thrasea, Arulenus Rusticus suffered a deadly doom; as did Herennius Senecio, for those of Helvidius Priscus. Nor upon the persons of the authors only was this fury wreaked, but also upon the books themselves; since to the Triumvirs orders were sent, that in the Forum the monuments of illustrious genius should be burned. Yes, in this very fire they imagined that the voice of the Roman people, the liberty of the Senate, and the conscience of humankind were being destroyed. For they had besides expelled all the professors of philosophy, and driven every laudable science into exile, that naught which was honest might anywhere be seen. Mighty surely was the proof which we gave of our patience; and as our forefathers had beheld how far liberty could go, so did we bondage, since through dread of informers and inquisitions of state, we are bereft of the common intercourse of speech and hearing. Nay, with our utterance we had likewise lost our memory, had it been as easy to forget as to be silent.

3. Now indeed at length our spirit returns. Yet, though at the first dawn of this very happy age Nerva Cæsar blended together two things once found irreconcilable, public liberty and empire; and though Nerva Trajan be daily augmenting the felicity of the state; and though the general security not only has our hopes and vows but even a firm assurance of their fulfilment, yet from the frailty of man much slower is the progress of the remedies than of the evils; and as our bodies grow slowly, and are subject to be destroyed in an instant, so it is much easier to suppress than to revive genius and its pursuits. For, upon the mind there steals a pleasure even in sloth and remissness, and that very inactivity which was at first hated, is at last loved. Will it not be found that during a course of fifteen years (a mighty space in the age of mortal man) numbers perished through fortuitous disasters, and all men of spirit were cut off by the cruelty of the Emperor? Few we are, who have escaped; and if I may so speak, we have survived not only others but even ourselves, when from the middle of our life so many years were rent; whence from being young we are arrived at old age, from being old we are come nigh to the utmost verge of mortality, all in a long course of awful silence. I shall not, however, regret having given an account of our former bondage, as also a testimony of our present blessings; though, in doing it, my style be negligent and unpolished. To the honour of Agricola, my wife's father, this book is in the meantime dedicated; and, as it is a declaration of filial duty and affection, will thence be commended, or at least excused.

4. A.D. 40. Cnæus Julius Agricola was born in the ancient and illustrious colony of Foro Julii, and both his grandfathers were procurators to the Emperors, that is, of the highest equestrian rank. His father Julius Græcinus was a Senator, and noted for eloquence and philosophy. By these his virtues, he earned the wrath of Caligula. For he was by him ordered to accuse Marcus Silanus, and put to death for refusing. His mother was Julia Procilla, a lady of singular chastity. Under her eye and tender care he was reared, and spent his childhood and youth in the continual pursuit and cultivation of worthy accomplishments. What guarded him from the allurements of the vicious (besides his own virtuous disposition and natural innocence) was, that for the seat and nursery of his studies, whilst yet very little, he had the city of Marseilles; a place well tempered and framed, as in it the politeness of the Greeks and provincial parsimony are blended together. I remember he was wont to declare, that in his early youth he would have studied philosophy and the law with more avidity than was allowable to a Roman and a Senator, had not the discretion of his mother checked his passion and ardour. In truth, his elevated genius thirsted, with more vehemence than caution, after the splendour and lustre of mighty and glorious reason. Reason and age afterwards qualified his ardour; and, what is a task extremely hard, he satisfied himself with a limited measure of philosophy.

CHEMISTRY.—XVII.

[*Continued from p. 6.*]

ETHYL COMPOUNDS, ALCOHOL, CHLORAL, ETHER, ACETIC ACID; FUSEL OIL; GLYCOL, OXALIC ACID; TARTARIC AND CITRIC ACIDS; URIC ACID, XANTHIN, CAFFEIN, THEIN; GLYCERIN, FATS AND SOAPS, NITROGLYCERIN, DYNAMITE.

ETHYL COMPOUNDS.

Ethyl Hydrate, Ethylic Alcohol, Ordinary Alcohol (C_2H_5HO).—This substance has been known since the earliest times; it was well known to the alchemist, who gave it various fanciful names: *aqua ardens*, the burning water; *aqua vitæ*, the water of life; *mercurius vegetabilis*, vegetable mercury; *spiritus vini*, the spirit of wine, etc. The name alcohol is probably of Arabic origin.

Alcohol occurs in small quantities in one or two plants, but is nearly always obtained by the fermentation of a solution of sugar by the yeast plant. In the case of wine, the grapes are broken up, and the grape-juice, or "must," in a short time ferments: the sugar in the juice splitting up into carbon dioxide and alcohol—

$$C_6H_{12}O_6 = 2C_2H_6O + 2CO_2;$$

small quantities of glycerin, succinic acid, etc., being simultaneously formed. In this case no yeast need be added, since the ferment exists on the grape skin. If red wine is required, the skins of the red grapes are allowed to remain after the alcohol is formed; white wine can be made from black grapes if the skins be removed before the production of the alcohol. If other fruits be used, as gooseberries, currants, etc., yeast is usually added to start the fermentation.

In making beer the starting-point was at one time exclusively malt: the first change which happens when a grain of barley is exposed to warmth and moisture is that the starch which it contains is converted by a peculiar ferment ("diastase"), existing in the seed, into a kind of sugar termed "maltose." As soon as this conversion of starch into sugar has been effected, the temperature of the malting floor is raised so as to kill the embryo, and prevent any further change. The malt is crushed and extracted with hot water, and a solution of maltose thus obtained; this is boiled with hops, the mixture allowed to cool to a temperature of about 60° Fahrenheit, and yeast added; the maltose is rapidly converted into alcohol, much carbon dioxide escapes, and the liquid, after it has been cooled and allowed to settle, is beer. In making "lager beer" a different kind of yeast is used, which works at a temperature slightly above the freezing-point of water, and sinks to the bottom of the vat instead of rising to the top. If dark-coloured beer, as porter and stout, is required, some of the malt is raised to a higher temperature, so as partly to char it. In a somewhat similar way alcoholic liquors can be obtained from the starch of potatoes, rice, maize, etc., also from the treacly residues left in the manufacture of beetroot and cane sugars. In wine obtained by simple fermentation of grape-juice the alcohol never exceeds more than about 15 volumes in 100 volumes of the wine; brandy, or some other form of spirit is usually added to sherry and port in order to confer greater keeping power; plaster of Paris is also added to most sherries to precipitate the tartaric acid which is often the cause of wine becoming thick and muddy.

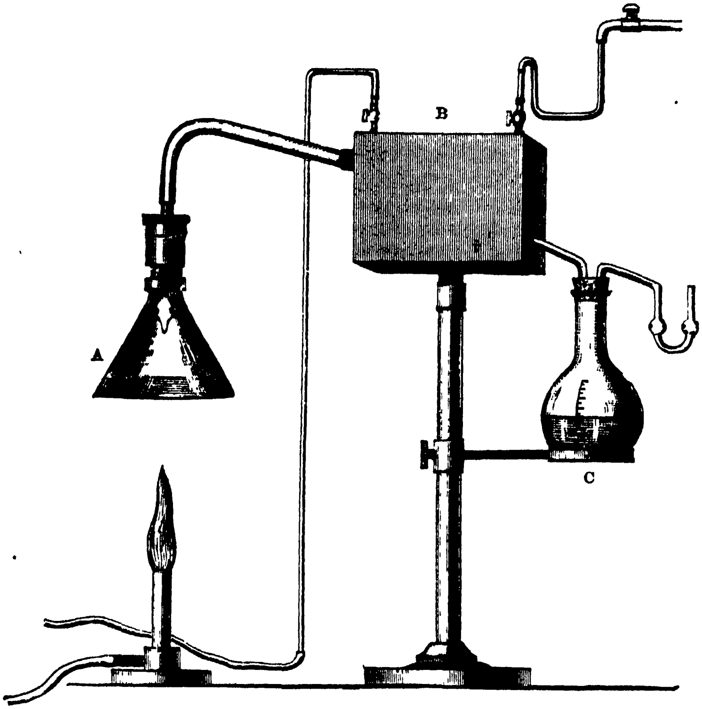


Fig. 50.—Apparatus for Testing the Amount of Alcohol in Wines, etc.
A, Distilling-flask; B, Condenser; C, Receiver.

The quantity of alcohol which a wine contains is estimated thus: a convenient quantity of the wine is placed in the glass flask A (Fig. 50) rendered alkaline with caustic potash and heated; when about two-thirds of the wine has distilled over into C the distillation is stopped; distilled water is then added to the fluid in C (which contains all the alcohol) until it has the same volume as the wine originally taken; the specific gravity of the diluted fluid is then determined, and the quantity of alcohol can be ascertained by reference to tables calculated for the purpose.

Rhine wine or hock contains 11 to 13 volumes of alcohol in 100 volumes of wine; claret, 10 to 12; burgundy, 11 to 13; sherry, 18 to 22; port, 18 to 23; beer, 2 to 6; gin, whisky, rum, and brandy vary from 36 to 60 volumes of alcohol in 100 volumes of the liquid.

Proof spirit contains 57 volumes of pure alcohol in 100, or 49·24 parts by *weight* of alcohol, in 100 volumes. In this country the strength of alcoholic liquids is often stated in degrees over or under proof; the real strength can be roughly ascertained by halving the number and adding the result to, or subtracting it from, 50: thus 60 overproof = approximately $\frac{60}{2}$

$= 30 + 50$, or 80 parts by *weight* of alcohol in 100 volumes of liquid; and 20 underproof $\left(\frac{20}{2} = 10\right)$ $= 50 - 10 = 40$ parts by weight of alcohol in 100 volumes of liquid.

In making bread in the ordinary way the alcoholic fermentation plays an important part: the yeast added to the dough causes the liberation of carbon dioxide, alcohol being simultaneously formed; the CO_2 separates the particles of the dough when heated in the oven, and so renders the bread light. New bread contains 0·314 per cent. of alcohol. When alcohol contains no water it is called "absolute alcohol"; this can be prepared from ordinary alcohol, or spirit of wine, by distilling it from freshly burnt quicklime. Methylated spirit is quite unfit for drinking, and so practically no duty is charged on it: it is made by mixing 90 parts of spirit of wine (containing about 91 per cent. of absolute alcohol) with ten parts of wood spirit (impure methylic alcohol). Methylated spirit is unknown on the Continent.

Pure alcohol is a colourless limpid liquid of an agreeable, though somewhat pungent, taste and odour, specific gravity 0·7938, boils at 78·4° Cent.; it is extremely useful for dissolving many substances insoluble in water. When chlorine is passed into alcohol for a long time, the alcohol is converted into *chloral*, a heavy oily liquid, CCl_3COH; when water is added to chloral a solid crystalline substance, chloral hydrate, $CCl_3CH(HO)_2$. is produced. When chloral or the hydrate is warmed with alkaline solutions, chloroform is produced—

$$CCl_3COH + KHO = \underbrace{CHCl_3}_{\text{Chloroform.}} + \underbrace{KCHO_2}_{\text{Potassium formate.}}.$$

Chloral hydrate is thus decomposed by the alkaline fluids of the body, and when taken internally produces insensibility, and eventually death.

Ethylic Oxide, Ether, Sulphuric Ether, $(C_2H_5)_2O$, is obtained by heating alcohol with a small quantity of sulphuric acid to a temperature of 130° to 150° Cent. Ether is a colourless, transparent, fragrant-smelling liquid, specific gravity ·72, boils at 35·6° Cent.; when dropped on the hand it causes a sensation of cold, owing to its rapid evaporation. If ether vapour be inhaled it produces insensibility, but it does not act so rapidly as chloroform.

Ethyl Hydrosulphide, Sulphur Alcohol, Mercaptan (C_2H_5HS) is a colourless liquid; its odour is intolerable, and adheres obstinately to the clothes. It is prepared by distilling potassium hydrosulphide, KHS, with calcium ethyl sulphate, $Ca(C_2H_5SO_4)_2$.

Ethyl forms many compounds with chlorine, bromine, sulphuric acid, etc., which we have not space to describe.

Acetic Acid, $\left\{\begin{matrix}CH_3\\COOH\end{matrix}\right.$ or $H(C_2H_3O_2)_2$ or $H\bar{A}$, is formed by the oxidation of alcohol—

$$C_2H_5HO + O_2 = HC_2H_3O_2 + H_2O.$$

Vinegar, which is a dilute solution of acetic acid (3 to 5 per cent.), is made on the large scale by trickling weak wine or beer over shavings, usually contained in a large tub, through which a continuous current of air passes; the brown colour is due either to burnt sugar, or to the colouring matter absorbed from the wood of the cask. Acetic acid is also one of the products of the distillation of hard woods, beech, etc., "wood vinegar."

The strongest acetic acid is obtained by heating sodium acetate with strong sulphuric acid; when cooled below 15·5° Cent. the liquid solidifies into a colourless crystalline mass, hence it is termed "glacial" acetic acid. At ordinary temperatures acetic acid is a colourless liquid of penetrating odour, which blisters the skin; it boils at 120° Cent.; the vapour burns with a blue flame.

Acetic acid attacks many metals, iron, copper, lead, etc., and forms a numerous and important class of salts, the acetates, which all evolve the odour of vinegar when heated with strong sulphuric acid.

Amylic Alcohol ($C_5H_{11}HO$), the alcohol of the radicle amyl, C_5H_{11}, is the principal constituent of "fusel oil," *i.e.*, the residue left after distilling the spirit from fermented potatoes (potato brandy), rye, etc.; it is said to occur in some cheap varieties of spirit, and in freshly made whisky. It is exceedingly poisonous, rapidly causing insensibility even inhalation of its vapour producing headache and giddiness.

The acids, as palmitic, margaric, stearic, etc., derived from the higher members of this series form important constituents of the fats, lard, suet, etc.; they are often called the fatty acids, and the name has been extended to the whole series of acids; it is also usually applied to the radicles, alcohols, etc., connected with these acids, thus we have the fatty series of alcohols, acids, radicles, etc.

We will now consider the derivatives of some of the dyad radicles.

Ethylene, or *Olefiant Gas* (C_2H_4), is one of the most important—it is the simplest member of the *Olefine* series; the lowest members of the series are gases and the highest solids, while the intermediate members are liquids. Like methyl, ethyl, etc., they form bromides, hydrates, etc.

Ethylene Hydrate, Ethylene Alcohol, or *Glycol*, $C_2H_4(HO)_2$, is a colourless syrupy liquid without smell, but has a slight sweet taste, hence its name glycol (Greek *glukus*, sweet); it mixes readily with alcohol and water, but not with ether; its constitution is expressed by the formula $\left\{\begin{matrix}OH_2OH\\CH_2OH\end{matrix}\right.$; when treated with nitric acid it is eventually converted into

Oxalic Acid, $\left\{\begin{matrix}COOH\\COOH\end{matrix}\right.$, or $H_2C_2O_4$, or $H_2\bar{O}$. This well-known acid occurs as the acid-potassium salt, $KH\bar{O}$, in the ordinary wood sorrel or shamrock (*Oxalis acetosella*), and in the common field sorrel (*Rumex acetosa*), to the leaves of which plants it gives a pleasant acidity. It is now manufactured on an enormous scale from pine sawdust. The sawdust is mixed with a strong solution of caustic potash, KHO, or a mixture of caustic potash and soda; the thick paste thus obtained is spread over iron plates in a thin layer; the plates are gradually heated to about 200° Cent., much inflammable gas and water being evolved; the heating is continued for some hours, when it is found that the brown mass contains about $\frac{1}{4}$th of its weight of oxalic acid as sodium or potassium oxalate. The oxalates produced are decomposed by boiling with milk of lime, $Ca(HO)_2$, and thus converted into insoluble calcium oxalate. The calcium oxalate is finally mixed with sulphuric acid, when gypsum and free oxalic acid are obtained; on evaporating the clear solution the latter crystallises out—

$$CaC_2O_4 + H_2SO_4 = CaSO_4 + H_2C_2O_4.$$

Ordinary crystallised oxalic acid has the composition $H_2C_2O_4 + 2H_2O$; it forms colourless and very acid crystals, which somewhat resemble Epsom salts, $MgSO_4$; they can be readily distinguished by heating on platinum foil or on a knife-blade: the crystals of oxalic acid will disappear completely, but the Epsom salts will leave a white residue of infusible magnesium oxide, MgO. Oxalic acid and the soluble oxalates are in large doses poisonous, the best antidote is finely divided chalk or "whiting." It forms an extensive series of salts, the oxalates, all of which, as well as the acid itself, when boiled with strong sulphuric acid, split into CO and CO_2: when oxalates of calcium, etc., are heated gently they are converted into carbonates, which effervesce when treated with an acid.

Tartaric Acid, $H_2(C_4H_4O_6)$, or $H_2\bar{T}$.—Our chief source of tartaric acid is grape-juice, in which it exists as the acid potassium salt, $HK\bar{T}$. Tartaric acid also occurs in many other fruits often mixed with malic acid, as in the mountain-ash berries, mulberry, pine-apple, etc. When the grapes are crushed, the grape-juice, or "must," contains the acid potassium tartrate in solution. As the sugar in the grape-juice is converted into alcohol the potassium tartrate, which is insoluble in alcohol, is deposited, usually coloured red, and forms the "argol," or impure "cream of tartar." This is dissolved in boiling water, and chalk added; the calcium tartrate thus precipitated is filtered off, and decomposed by adding sulphuric acid at a temperature of 75° Cent. The clear solution is evaporated, when the tartaric acid crystallises out in large transparent colourless crystals. Tartaric acid is fairly soluble in water, and in alcohol; it is used in medicine, in calico-printing, etc. It forms several important salts.

Cream of Tartar, or *Acid Potassium Tartrate* ($HK\bar{T}$).—The crude "argol" mentioned above is dissolved in hot water and recrystallised; it forms colourless crystals, which have a pleasant acid taste; it is used in the preparation of pure potassium carbonate, and in medicine.

Rochelle or *Seignette Salt* ($NaK\bar{T}+4H_2O$).—This is the neutral sodium potassium tartrate; it is prepared by adding cream of tartar to a boiling solution of sodium carbonate until the whole is neutral, the solution is then allowed to cool, and the Rochelle salt crystallises out. It is a mild aperient, and is used in medicine; it forms the bulk of the powder in the blue paper of the Seidlitz powder.

Tartaric acid and the tartrates, when boiled with strong sulphuric acid, blacken, and evolve SO_2 and an odour of burnt sugar.

Citric Acid, $C_3H_4HO(COOH)_3$ or $H_3(C_6H_5O_7)$, is the essential acid in lemons, oranges, etc.; it is also found in the gooseberry, currant, strawberry, raspberry, cherry, etc., mixed with malic acid. It is usually prepared from lemon-juice; this liquid is heated nearly to the boiling-point, and powdered chalk added until effervescence is no longer produced; a little slaked lime, $Ca(HO)_2$, is then stirred in; calcium citrate is thus precipitated; this precipitate is washed and decomposed with the exact quantity of sulphuric acid required; the clear liquid is poured off, and on evaporation gives colourless transparent crystals of citric acid. This acid is used in medicine, in dyeing and calico-printing.

Uric Acid ($C_5H_4N_4O_3$).—This acid differs from the previous acids in containing nitrogen; it is one of the forms in which nitrogen is discharged from the body; it is intimately connected with an interesting series of bodies. It occurs to a small extent in the urine of man, whilst ammonium urate forms the principal part of the solid excrement of snakes and other reptiles; sodium urate is often deposited in the joints of gouty subjects. Uric acid and urates are sometimes found in the concretions or stones which occasionally occur in the bladder. Uric acid is usually prepared from guano. When pure it forms a white powder, which consists of very minute crystals; it is almost insoluble in cold water, 1 part of uric acid requiring 1,400 of cold water, but dissolves in caustic soda, NaHO, and in KHO.

The presence of uric acid can be detected by adding a small quantity of strong nitric acid, and then evaporating to dryness in a small porcelain dish, taking care not to overheat the residue; this is best secured by holding the dish in the fingers; a reddish residue is thus obtained, which is turned purple by the addition of ammonia, NH_4HO, and violet by caustic potash, KHO. These colours are due to the formation of the ammonium and potassium salts of "purpuric acid," $C_8H_5N_5O_6$. The ammonium purpurate is usually called "murexide," and has given its name to the reaction just described, which is termed the murexide test. At one time murexide was manufactured from guano on a large scale (12 cwt. per week) for dyeing purposes, but the industry became extinct soon after the introduction of the brighter and cheaper anilin dyes.

By the action of sodium amalgam (a mixture of metallic sodium and mercury) on uric acid it can be deprived of an atom of oxygen, and thus converted into xanthin, $C_5H_4N_4O_2$, which substance can also be obtained from guanin, $C_5H_5N_5O$, and this in its turn can be prepared from Peruvian guano; both xanthin and guanin are white powders, almost insoluble in water. These bodies are curiously enough closely related to "theobromin," the active ingredient in cocoa and chocolate, and to thein or caffein, the substance which endows tea and coffee with their well-known action on the nervous system. Thus theobromin, which can be extracted from cocoa, has the formula $C_5H_2(CH_3)_2N_4O_2$; if this be compared with xanthin, $C_5H_4N_4O_2$, it will be seen that theobromin is dimethylxanthin, *i.e.*, two atoms of the hydrogen in xanthin have been replaced by two methyl, (CH_3), groups. In caffein or thein the replacement has gone further, and this substance, $C_5H(CH_3)_3N_4O_2$, is trimethylxanthin. These bodies have accordingly been prepared from xanthin, which in its turn can be derived either from uric acid or from guanin. So that it is possible that the enterprising chemist of the future may prepare his "concentrated essence of tea, coffee, and cocoa" from Peruvian guano.

Both theobromin and caffein are crystalline powders slightly soluble in water. Coffee-beans contain from ½ to 2 per cent. of caffein, tea contains 1½ to 3 per cent.; caffein is poisonous, seven grains proving fatal to a cat.

We will now consider some derivatives of trivalent radicles. The most important of these is propenyl, since its hydrate or alcohol, $C_3H_5(HO)_3$, is *glycerin*. As we have previously stated, suet, lard, etc., contain fatty acids; they are, in fact, salts in which stearic acid, etc., are combined with a trivalent radicle propenyl, C_3H_5. When these fats are boiled for some time with sodium hydrate, NaHO, or caustic potash, KHO, the following decomposition occurs (the formula of stearic acid, $H(C_{18}H_{35}O_2)$, is written $H\bar{S}t$ in order to simplify the equation):—

$$\underset{\text{Fat.}}{(C_3H_5)\bar{S}t_3} + 3NaHO = \underbrace{C_3H_5(HO)_3}_{\text{Propenyl hydrate or glycerin.}} + \underbrace{3Na\bar{S}t,}_{\text{Sodium stearate or ordinary soap.}}$$

and we get as products a solution of glycerin and ordinary soap. In order to separate out the soap, a quantity of common salt is thrown into the solution, and the soap, being insoluble in salt water, floats on the top; this is termed "salting out" the soap: ordinary hard soap is sodium stearate, palmitate, etc., soft soap is the potassium salt of similar acids, and usually contains glycerin; if hard soap is properly made it should contain no glycerin. When soap is dissolved in much water, free alkali, NaHO or KHO, is liberated; this considerably facilitates the removal of grease, dirt, etc. As to the effect of hard water on soap *see* Vol. III., p. 5. If soap be boiled with any of the mineral acids, the fatty acids are set free—

$$Na\bar{S}t + HCl = NaCl + H\bar{S}t.$$

If a fat be distilled in a current of superheated steam (*i.e.*, steam heated above 100° Cent.), it is split up into a free fatty acid, which can be used in candle-making, and glycerin, which passes over with the steam. Glycerin thus obtained is purified by redistillation, or by cooling it to a very low temperature (0° Cent.), when it crystallises, and the liquid impurities can be poured off. When pure, it is a viscid liquid having a sweet taste; it can be mixed with water in all proportions; it dissolves many metallic oxides, as lime, also lead, copper, and iron oxides. If a bead of borax be moistened with glycerin, the boracic acid is liberated and the bead gives a green colour to the Bunsen flame. Glycerin does not ferment like ordinary sugar, it is extensively used for mixing with inks to prevent them drying up, for softening the skin, glue, etc., but by far the largest quantity is used for the manufacture of nitroglycerin.

Nitroglycerin, $C_3H_5(NO_3)_3$, is a colourless heavy oily liquid with a sweet taste, even minute quantities produce violent headache, in large quantities it is poisonous; the workmen after a time seem to be exempt from the headache and other symptoms. It is prepared by adding pure glycerin to a cooled mixture of sulphuric and strong nitric acids, the whole being constantly mixed; the nitroglycerin separates out, being insoluble in the fluid, and is finally well washed with water. The manufacture is dangerous and requires very great care.

Nitroglycerin solidifies about 20° Cent.; it explodes, when heated or struck, with fearful violence. In this country it is absorbed by a peculiar form of silicious earth termed "Kieselguhr," which consists of microscopic shells of pure silica, perforated in every direction with minute tubes; this earth soaks up the nitroglycerin (like a sponge does water), forming a soft powder. In this state it is known as "dynamite," and is much safer to handle and easier to transport; dynamite explodes with terrible violence if suddenly heated, struck, or detonated with a percussion-cap. Both nitroglycerin and dynamite if lighted with a match usually burn away without exploding. In other countries various materials are used to absorb the nitroglycerin, as wood-fibre, sawdust, etc.

ENGLISH LITERATURE.—I.

INTRODUCTION.

The literature of England is a collection of works of art, each one of which should be studied separately for the sake of its individual excellence. Such a study will develop the taste and judgment, and give pleasure in proportion to the capacity of the student: it requires only diligence in reading, and sufficient discernment to appreciate what is read. All that a teacher can do to assist is to point out what are the works most worthy of study, to call attention to some of their more prominent beauties, and to acquaint the student with the history of their authors. This service we hope to render in the course of the following lessons, so far as our space permits us.

But those who would gain the full benefit of the study of English literature must regard it from a wider point of view. The literature of a country is one of the most instructive parts of its history. Every thoughtful student of history seeks to know not only what men have done, but what they have thought and felt. He seeks to know not merely the great external events of the period he is studying—the wars, the revolutions, the religious controversies, the social struggles—but also the motives which influenced men, the extent of their knowledge, their standard of right and wrong, their likes and dislikes: in short. he wishes to know not men's acts only, but men themselves; and for this he must look chiefly to the literature they have left behind them. Every student of English literature, then, should endeavour to trace in all the beautiful poetry or eloquent prose that he reads the history of the times in which the works he studies were written.

It is not merely that he will find historical facts embedded in what he reads, which he might not meet with elsewhere, though this is true; but he will also often find such facts related by eye-witnesses, and, therefore, with all that freshness and vividness of description which stimulates the imagination and impresses the memory. He will, moreover, be able to observe for himself, and at first hand. what effect was produced upon men's minds at the time by the great events of history with which he is only familiar by the help of historians.

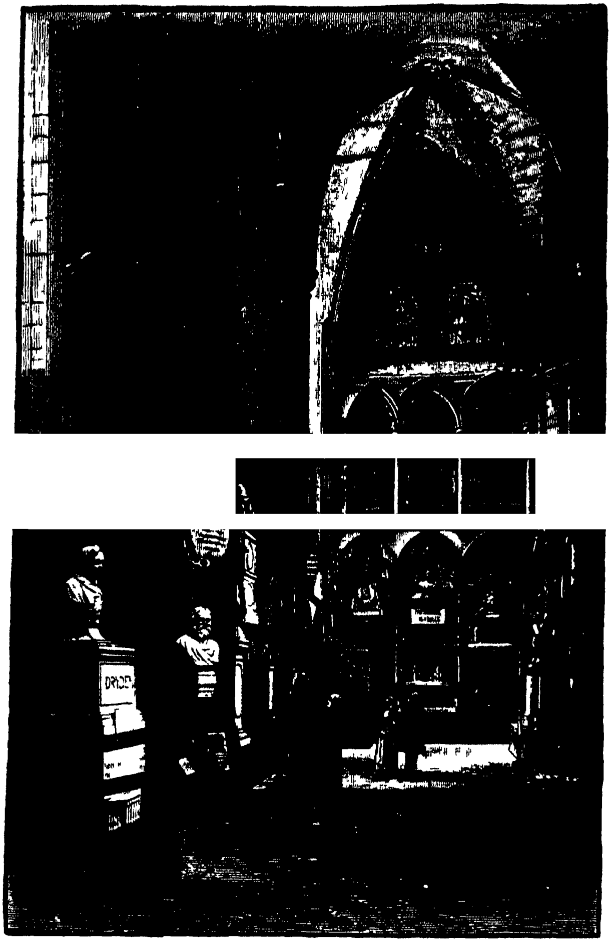
All these things are important. But the connection between national history and a national literature lies much deeper still; and it is of the utmost importance that every student of literature should at the outset clearly realise this. Everyone must observe that literature in England has not been like a river flowing on in a steady and unbroken course; but has ebbed and flowed like the tide, though without the regularity of the tide. In the days of Edward III., at the close of the fourteenth century, there was produced a great mass of literature, of which Chaucer's poems are the most important examples. For a century afterwards there is almost a total blank. Then began gradually the revival, which culminated in the days of Elizabeth and James I. in an amount of literary life such as has never been seen in England before or since—the age of Shakespeare and the great dramatists, of Spenser and countless other poets. And the same alternation of activity and depression is to be seen throughout the whole history of our literature. But what it is important for the student to observe is, that these changes are not isolated or meaningless events. Literary activity is only one of the many forms in which an increased mental energy exhibits itself, and a period fertile in great books is sure to be a period fertile in great deeds and in great changes. Thus the age which produced the poetry of Chaucer was the same in which the feudal organisation of society was broken up, the same in which the national spirit and vigour of England displayed itself in the French conquests of Edward III., the victories of Cressy and Poitiers; and the same in which Wiclif led the first great religious reformation in England, the first rebellion against the superstitions of the dark ages and the corruptions of the clergy. The century of literary dearth that followed was a century of national depression, in which the country was desolated by the Wars of the Roses. The Elizabethan era, so rich in literary genius, was also the era of the revival of classical learning, of the Reformation, of the Spanish wars and the defeat of the Armada, of the voyages of Drake and the other great navigators, and of the first English colonisation of America.

But not only is the amount of literary genius shown at different periods seen to be very different; the character and spirit of the works produced varies not less, and this diversity is closely connected with the history of the times. Thus the same exuberance of life and energy, seeking a vent for itself in every direction, which in the days of Elizabeth and her successor sent English sailors and adventurers about the world, discovering strange lands, fighting—half as lawful warriors, half as pirates—on the Spanish main, or colonising Virginia, is apparent in all Elizabethan dramatists, and above all in Shakespeare. Their characteristics are activity of invention, freedom, and variety. The same patriotic pride and unity of national spirit which was shown when the Armada threatened our shores is prominent in the literature of the period. It is the very keynote of at least one of Shakespeare's plays, *Henry V.* But the next generation of Englishmen lived in a very different world. England was no longer a united nation. The king—Charles I.—and his people have been alienated from one another, the liberties of the nation are at stake, the civil war ensues; and the political contest is intensified and embittered by the religious differences which are so closely connected with it. The day is one in which every man is compelled to choose his side in a contest of surpassing importance; and men do choose their sides, and maintain them with rare earnestness and fidelity. And how does this change of spirit in men show itself in literature? The representative of the literature of the age is Milton. Milton in power of genius falls behind none of the Elizabethan poets, except Shakespeare himself; but in tone and spirit his works stand in the strongest contrast to theirs. Seriousness of spirit, earnestness of purpose, and an intense realisation of the presence of the unseen, are the characteristics of everything he has left us. Nor is the change less instructive in the next generation. The Commonwealth was followed by the Restoration. The cavalier party became in the ascendant. A natural reaction against the extreme austerity of puritanism, combined with the evil example of a licentious court, produced a tone of morality lower than anything that had ever been known in England before; and this is immediately reproduced in the literature of the day. Dryden and the school of comedy writers whom we shall have to describe hereafter are its chief representatives, and they stand in the most marked contrast to the writers of the previous generation in the entire absence of any serious or earnest purpose, and in their gross immorality.

Nor is it only the changes and movements taking place within our own country which we may see thus faithfully reflected in the literature of each age. The study of literature enlarges our view and enables us to watch the influence which one nation has exercised upon another, either by means of its living thinkers and writers, or by its older literature. Thus we all read, as a matter of history, that at the time of the first great harvest of English literature, in the reign of Edward III., the chief impulse to literary activity both in England and elsewhere was derived from Italy, for in that country there had but shortly before been produced the great works of Dante, Boccaccio, and Petrarch. But the extent of this influence can only be appreciated by reading Chaucer's poems, and observing how he—really one of the most original of poets—is indebted for his stories, for his metres, and to a large extent for his style, to Italian models. This our readers will see more fully when we come to treat of Chaucer's poems in detail. In the same way we read of the great effect produced in England, as elsewhere, during the Elizabethan era, by the revival of classical learning, through study of the originals by the few, through the medium of translations with the many. There is no way in which this influence can be more fully realised than by observing how a man like Shakespeare, who had "small Latin and less Greek," was affected by it. Play after play, as *Julius Cæsar*, and *Antony and Cleopatra*, is taken from classical sources; and in each he shows not only that he can follow the narrative as he read it, probably in translation, but that he had largely entered into the spirit and feeling of the time.

We have said enough to show that the student of English literature has the opportunity of reading English history in the fullest, best, and most reliable way, for he is enabled to get a step nearer to the men with whose history he is dealing than he can do by any other method. But the advantage of keeping the connection between literature and history always in view is not entirely on the side of history. We have said that the various books which go to make up the total of English literature may be studied as isolated works of art, and may be so studied with both pleasure and profit. No man, for instance, could read *Hamlet* without enjoyment, whether he knows anything of Shakespeare and his times or not. But the pleasure we receive and the benefit we derive from a great work is in proportion as we understand the author's meaning; and we understand his meaning in proportion as we are able by an effort of imagination to put ourselves in his place, to see things as he saw them, to judge them as he judged them, and above all to remember that the knowledge that we in the present day possess, and the sentiments by which our actions and thoughts are guided, are greatly in advance of those of our forefathers. And we shall be able to do this to a very small extent indeed if we are not fully acquainted with the circumstances under which he wrote and the influences by which he was surrounded. For all reasons therefore, we would impress upon our readers the importance, when reading any English author, of doing so with as full a knowledge as they can obtain of his character, his history, and his times.

But in order that English literature may be studied in the manner and from the point of view which we advise, it is necessary that the student, when he enters upon the study of any work, should have the means of at once assigning to it its proper date in the catalogue of literature. This he cannot do without having the history of our literature, at least in its broader features, mapped out in his mind, knowing the sequence of the great writers, and their connection with one another, and the characteristics of each literary period. Such a knowledge is the more easily attained, because our literature easily and naturally divides itself into several well-marked periods, corresponding very closely to the most important stages in our political history. The object of the following lessons will be to enable students of English literature to acquire this knowledge, so necessary for a thoroughly useful system of reading, as well as to direct their choice of books, and to give them such assistance as may be possible in understanding and appreciating what they read.



Poets' Corner, Westminster Abbey.

In laying out the outline of a history of English literature, the first thing to be determined is the point from which to date its commencement. And as to this there is, we think, little room for hesitation. English literature, for the purposes of the ordinary student, begins with the age of Chaucer, the latter half of the fourteenth century, the reign of Edward III. Before that time there had been many works written in England, and in different languages, but it could not be said that there was any literature addressing itself to the whole people of England, or written in a language which was that of the whole people.

The population of England had been recruited from many sources. (*See* Historic Sketches, No. I.) The oldest inhabitants of the island of whom history gives us any account were of Celtic blood, akin to the Celts of Ireland and the Highlanders of Scotland, but much more nearly akin to those who still, to a great extent, people Wales and Cornwall. They fell under the yoke of the Roman Empire, and for five hundred years Roman institutions and Roman civilisation prevailed in the country. The Romans abandoned their occupation of Britain in the middle of the fifth century, but they did not leave the Britons to the enjoyment of peace or security. Immediately after, if not before, the departure of the Romans, a dangerous friend, soon to become a formidable enemy, had appeared on the coasts of Britain. The Saxons, a people from the banks of the Elbe and the shores of the German Ocean, had commenced their long series of invasions. The history of the struggle between the Saxons and the Britons is lost in obscurity, but it ended in the complete subjugation of Britain under the Saxon dominion; and some form of their language—a language of the German stock, and the parent of our modern English—has ever since been the language of the great bulk of the inhabitants of this island. The Danes were the next invaders; but though they established their dominion for long, and although their tongue no doubt materially modified the dialect of those parts of England with which they had most to do, the language of the country remained substantially unchanged; and it may be said that at the date of the Norman Conquest, with the exception of the Celtic-speaking districts, which we need not here consider, the language of England was one, and that was Anglo-Saxon (or First-English).

But the Norman Conquest brought a great change. The Normans, or Northmen, who invaded and conquered England under William of Normandy, were a Scandinavian race, nearly akin to the Danes; but during their long abode in the province of Normandy they had abandoned their original tongue, and adopted the language of those they had vanquished; and French was the language which they carried with them into England. From this time onward there were two spoken languages in England—the Norman-French of the court and the feudal castles, and the Saxon of the mass of the people. Each of these languages had its writers, books intended for the nobles being written for the most part in French, those intended for the people in Saxon. But there was also a third kind of literature in this country. In the monasteries, which were scattered over all parts of the country, chroniclers and religious writers used Latin as their literary tongue.

We have spoken of the Saxon tongue as the parent of our modern English, and we have just spoken of the Saxon literature which preceded the period at which the history of English literature properly begins. And it may therefore be asked why we arbitrarily select a particular point of time after which we say the literature was English, while what went before was not? In answer to this, we say that we do not draw the line at the point at which we have drawn it on the ground of any sudden or marked change in the language, though the language did undergo much modification at the very period in question; but for the reason we have given above, that the Saxon or English literature before Chaucer's day was not the literature of the whole English nation, but of the English-speaking portion of the nation: in his time it became that of the nation. The changes by which the language of the first Saxon invaders has in the course of centuries been transformed into the English of our day have been very gradual; and there is no one point of time at which it can be said that Anglo-Saxon became English. But in order to make more clear what we shall say in future lessons, it is well that our readers should be acquainted with the several stages into which the progress of the language is most conveniently divided. It must be remembered, however, that these divisions are not always very clearly marked, and are not given in quite the same way by all authorities. The language was *Anglo-Saxon* down to about the middle of the twelfth century; and the name *Transition English* is given to it for the next hundred years, down to the middle of the thirteenth century. From that time until the end of the fourteenth century it is called *Old English*. Then the name of *Middle English* is applied to the English in use down to the reign of Elizabeth; and after that period the language may be called *Modern English.*

In our next lesson we shall give a brief account of the remains which have come down to us of those various forms of literature—Anglo-Saxon, Norman-French, and Latin—previous to the date at which we commence the history of English literature proper.

But by the days of Edward III. the English language had completely supplanted, while it partly absorbed, the French of the Norman nobles, and had become the language of the whole nation. And that period, the age of Chaucer, is our first period in the history of English literature.

The second period extends from the death of Chaucer over a space of about a hundred years, down to the time of the first revival of literary energy under the Tudor sovereigns.

The third period extends from the first revival of literature, at the period we have mentioned, through the reigns of Elizabeth and James I., and includes within it the most brilliant portion of our literary history.

The fourth period is that which includes the reign of Charles I., the Civil War, and the Commonwealth.

The fifth period is that of the Restoration, beginning with that event, and extending down to the Revolution of 1688.

The sixth period extends from the Revolution, through the reign of Queen Anne and the earlier portion of those of the Georges, and includes what has been habitually called the Augustan age of English literature, or the age of the *correct* school.

The seventh period is that which is intermediate between the last-mentioned and the great revival of romantic literature at the end of the eighteenth century.

The eighth period is that of the revival of the romantic school of literature, which began in the reign of George III., under the impulse of the same intellectual movement which immediately preceded the great French Revolution, the period to which belong Scott, Byron, and Shelley, and which may be said scarcely yet to have come to an end.

In the following course of lessons we shall treat of these periods in order, and of the principal writers belonging to each of them, examining as fully as we can the most important works of these writers.

GREEK.—VIII.

[*Continued from p.* 15.]

THE SECOND DECLENSION CONTRACTED.

A DEVIATION from the usual form of the Second Declension may here claim the student's attention.

A few substantives in which an *ο* or an *ε* stands before the case-endings undergo contraction. For the principles which regulate contraction, the student must refer to lesson I., Vol. V., p. 22. He should learn both the uncontracted and the contracted forms, first horizontally, as **πλόος**, **πλοῦς**; **πλόου**, **πλοῦ**, etc.; then perpendicularly, as **πλόος**, **πλόου**, **πλόῳ**, uncontracted; and **πλοῦς**, **πλοῦ**, **πλῷ**, contracted. Thus are declined **ὁ πλόος**, *a sailing* or *voyage;* **ὁ περίπλοος**, *a sailing round* or *circumnavigation;* and **τὸ ὀστέον**, *a bone.*

EXAMPLES OF CONTRACTED NOUNS (SECOND DECLENSION).

	Uncontracted.	*Contracted.*	*Uncontracted.*	*Contracted.*	*Uncontracted.*	*Contracted.*
	Singular.					
Nom.	πλόος	πλοῦς.	περίπλοος	περίπλους.	ὀστέον	ὀστοῦν.
Gen.	πλόου	πλοῦ.	περιπλόου	περιπλοῦ.	ὀστεου	ὀστοῦ.
Dat.	πλόῳ	πλῷ.	περιπλόῳ	περιπλῷ.	ὀστέῳ	ὀστῷ.
Acc.	πλόον	πλοῦν.	περίπλοον	περίπλουν.	ὀστέον	ὀστοῦν.
Voc.	πλόε	πλοῦ.	περίπλοε	περίπλου.	ὀστέον	ὀστοῦν.
	Plural.					
N.V.	πλόοι	πλοῖ.	περίπλοοι	περίπλοι.	ὀστέα	ὀστᾶ.
Gen.	πλόων	πλῶν.	περιπλόων	περιπλῶν.	ὀστέων	ὀστῶν.
Dat.	πλόοις	πλοῖς.	περιπλόοις	περιπλοῖς.	ὀστέοις	ὀστοῖς.
Acc.	πλόους	πλοῦς.	περιπλόους	περιπλοῦς.	ὀστέα	ὀστᾶ.
	Dual.					
N.A.V.	πλόω	πλῶ.	περιπλόω	περιπλω.	ὀστέω	ὀστώ.
G.D.	πλόοιν	πλοῖν.	περιπλόοιν	περιπλοῖν.	ὀστέοιν	ὀστοῖν.

After this manner decline the multiplicative adjective ending in *-όος* (*-οῦς*), *-όη* (*-ῆ*), *-όον* (*-οῦν*), as **ἁπλοῦς**, **ἁπλῆ**, **ἁπλοῦν**, *single* or *simple;* also, adjectives of two terminations in *-όος* (*-οῦς*) and *-όον* (*-οῦν*). formed from the substantive **νόος** (**νοῦς**), *the mind*, as **ὁ**, **ἡ εὔνους**, **τὸ εὔνουν**, *well-minded* (that is, *well-disposed*); and from the substantive **πλόος** (**πλοῦς**), as **ὁ**, **ἡ εὔπλους**, **τὸ εὔπλουν**, *voyaging successfully;* and adjectives ending in **-εος**, and denoting that of which a thing is made, as *χρύσεος* (*χρυσοῦς*), *χρύσεα* (*χρυσῆ*), *χρύσεον* (*χρυσοῦν*), *golden.*

Remember that in the neuter plural, and in all cases after a vowel or *ρ*, *-εα* is contracted into *-ᾶ*: *e.g.*—

> *ἀργύρ-εος* (*ἀργυροῦς*), *ἀργυρ-έα* (*ἀργυρᾶ*), *ἀργυρ-έον* (*ἀργυροῦν*), *of silver.*

The rules for contraction given above (Vol. V., p. 22) must be carefully studied, especially those applying to contracted adjectives.

Note also that—whatever the accent is on the uncontracted form—the contracted syllable is always accented circumflex, except in the nominative, accusative, and vocative masculine and neuter of the dual.

EXAMPLES OF CONTRACTED ADJECTIVES (SECOND DECLENSION).

	ὁ	ἡ	τὸ	ὁ	ἡ	τὸ
	Singular.					
N.V.	χρυσοῦς	χρυσῆ	χρυσοῦν.	ἁπλοῦς	ἁπλῆ	ἁπλοῦν.
Gen.	χρυσοῦ	χρυσῆς	χρυσοῦ.	ἁπλοῦ	ἁπλῆς	ἁπλοῦ.
Dat.	χρυσῷ	χρυσῇ	χρυσῷ.	ἁπλῳ	ἁπλῇ	ἁπλῷ.
Acc.	χρυσοῦν	χρυσῆν	χρυσοῦν.	ἁπλοῦν	ἁπλῆν	ἁπλοῦν.
	Plural.					
N.V.	χρυσοῖ	χρυσαῖ	χρυσᾶ.	ἁπλοῖ	ἁπλαῖ	ἁπλᾶ.
Gen.	χρυσῶν	χρυσῶν	χρυσῶν.	ἁπλῶν	ἁπλῶν	ἁπλῶν.
Dat.	χρυσοῖς	χρυσαῖς	χρυσοῖς.	ἁπλοῖς	ἁπλαῖς	ἁπλοῖς.
Acc.	χρυσοῦς	χρυσᾶς	χρυσᾶ.	ἁπλοῦς	ἁπλᾶς	ἁπλᾶ.
	Dual.					
N.A.V.	χρυσώ	χρυσᾶ	χρυσώ.	ἁπλώ	ἁπλᾶ	ἁπλώ.
G.D.	χρυσοῖν	χρυσαῖν	χρυσοῖν.	ἁπλοῖν	ἁπλαῖν	ἁπλοῖν.

VOCABULARY.

Ἄδηλος, *-ον*, unknown.

Ἀλήθεια, *-ας*, *ἡ*, truth.

Ἄνους, *-ουν* (*α*, *not*, and *νόος*), unintelligent, senseless.

Ἄρτος, *-ου*, *ὁ*, bread.

Δῆλος, *-η*, *-ον*, known, evident, clear.

Ἐκκαλύπτω, I uncover.

Ἐπικουφίζω, I lighten.

Ἐρίζω, I contend, I am in strife with someone.

Εὐνοῦς, -**ουν**, well-disposed, benevolent.

Θεράπαινα, -**ης**, **ἡ**, a female servant.

Καὶ—**καὶ**, both—and.

Κάνεον (-**οῦν**), -**ου**, **τὸ**, a small basket.

Κάτοπτρον, -**ου**, **τὸ**, a mirror.

Κύπελλον, -**ου**, **τὸ**, a goblet.

Λέγω, I say, I name.

Νοῦς, -**οῦ**, **ὁ**, the understanding, the mind, the soul.

Ὀλίγος, -**η**, -**ον**, few.

Ὀργή, -**ῆς**, **ἡ**, anger.

Ὀρέστης, -**ου**, **ὁ**, Orestes.

Ὄχλος, -**ου**, **ὁ**, a multitude, crowd.

Προσφέρω, I carry, I bring to.

Σύν, with.

Τεγέα, -**ας**, **ἡ**, Tegea, a city in Arcadia.

Τέκνον, -**ου**, **τὸ**, a child.

Ὕπνος, -**ου**, **ὁ**, sleep.

Χαλινός, -**οῦ**, **ὁ**, a bridle, rein.

Χάλκεος, -**έα**, -**εον**, brazen, made of brass.

Ψυχή (English *Psyche*), -**ῆς**, **ἡ**, the soul.

Exercise 47.

Translate into English :—

1. *Λόγος κάτοπτρόν ἐστι τοῦ νοῦ.* 2. *Τὸν νοῦν ἔχουσιν οἱ ἄνθρωποι διδάσκαλον.* 3. *Τὸν εὐνοῦν φίλον θεράπευε.* 4. *Οἱ ἀγαθοὶ φίλοι πιστὸν νοῦν ἔχουσιν.* 5. *Ὁ πλοῦς ἐστιν ἄδηλος τοῖς ναύταις.* 6. *Σὺν νῷ τὸν βίον ἄγε.* 7. *Ὁ ὄχλος οὐκ ἔχει νοῦν.* 8. *Μὴ ἔριζε τοῖς ἀνθρώποις.* 9. *Οἱ ἀγαθοὶ τοῖς ἀγαθοῖς εὖνοι εἰσιν.* 10. *Ὀρέγου φίλων εὐνῶν.* 11. *Τὰ Ὀρέστου ὀστᾶ ἐν Τεγέᾳ ἦν.* 12. *Αἱ θεράπαιναι ἐν κανοῖς τὸν ἄρτον προσφέρουσιν.* 13. *Οἱ θεοὶ καὶ καλὸν καὶ κακὸν πλοῦν τοῖς ναύταις παρέχουσιν.* 14. *Ψυχῆς χαλινὸς ἀνθρώποις ὁ νοῦς ἐστιν.* 15. *Πολλάκις ἡ ὀργὴ ἀνθρώπων τὸν νοῦν ἐκκαλύπτει.* 16. *Ἁπλοῦς ἐστιν ὁ τῆς ἀληθείας λόγος.* 17. *Λόγος εὐνοῦς ἐπικουφίζει λύπην.* 18. *Τὸ κύπελλόν ἐστιν ἀργυροῦν.* 19. *Ὁ θάνατος λέγεται χαλκοῦς ὕπνος.*

Exercise 48.

Translate into Greek :—

1. The understanding is a teacher to men. 2. The well-disposed friend is honoured (*θεραπεύω*). 3. Well-disposed friends are honoured. 4. To the well-disposed are many friends (*that is*, the well-disposed have many friends). 5. Abstain from the senseless. 6. Strive after benevolent friends. 7. Bring the bread in a basket. 8. Avoid senseless youths. 9. Senseless youths are avoided. 10. The goblet is golden. 11. Silver goblets are beautiful. 12. Pass life with understanding. 13. Contend ye not with the senseless.

Remark that, as a general rule, the subject (or what is commonly called the nominative) has the article, the predicate being without it. Thus, if, as in the last Greek sentence, you meet with a sentence having two nouns connected by the verb *εἶναι*, take first (that is, take as the subject) that which has the article before it, as :—

Subject.			*Predicate.*
ὁ θάνατος	*λέγεται*	*χαλκοῦς*	*ὕπνος.*
Death	is called	a brazen	sleep.

COMPARISON OF ADJECTIVES.

Superlative (Latin super, *above*, *beyond*, and latus, *carried*) is in grammar applied to adjectives when they are in that form which signifies the greatest degree or amount of the quality described by them. As in Latin and English, the superlative in Greek denotes either the highest degree of a quality, or a very high degree. The degree below, or an inferior degree of the quality, is called the *comparative* ; and the simple state of the adjective is named the *positive*. For example, *sweet* is the positive, *sweet-er* the comparative, and *sweet-est* the superlative.

The Greek language has two forms of comparison. The first, and by far the most common, is to add to the stem of the positive *-τερος*, *-τερᾱ*, *-τερον* for the comparative, and *-τατος*, *-τατη*, *-τατον* for the superlative ; and the second has the endings for the comparative *-ῑων*, *-ῑον* or *-ων*, *-ον*, and for the superlative *-ιστος*, *-ιστη*, *-ιστον*. This second form is found with very few words, but they are words in very general use.

In some words which take the form *-τερος*, etc., the stem is first modified in the manner explained hereafter.

Instead of these ordinary forms, the comparative may be indicated by *μᾶλλον*, *more*, and the superlative by *μάλιστα*, *most*, put before the adjective. But the regular forms should generally be used when they exist. They may be grouped under the two main forms, as follows :—

I. The First Form.

	MASC.	FEM.	NEUT.
Comparative.	*-τερος*	*-τερᾱ*	*-τερον.*
Superlative.	*-τατος*	*-τατη*	*-τατον.*

Most of the adjectives of this class simply add the forms of comparison to the stem. But in stems ending in *omicron* (*-ο*), the vowel is lengthened to *omega* (*-ω*) when the preceding syllable of the stem is short : *e.g.*—

(*a*) -O **stems** :—

Positive.	*Stem.*	*Comparative.*	*Superlative.*
κοῦφος, light.	(*κοῦφο-*)	*κουφό-τερος.*	*κουφό-τατος.*
ἰσχῡρός, strong.	(*ἰσχῡρο-*)	*ἰσχῡρό-τερος.*	*ἰσχῡρό-τατος.*
λεπτός, thin.	(*λēπτο-*)	*λεπτό-τερος.*	*λεπτό-τατος.*
σοφός, wise.	(*σŏφο-*)	*σοφώ-τερος.*	*σοφώ-τατος.*
ἐχῠρός, secure.	(*ἐχῠρο-*)	*ἐχῠρώ-τερος.*	*ἐχῠρώ-τατος.*

Contracted words in *-εος*, *-οῦς*, undergo contractions also in the comparative and superlative : *e.g.*—

	Uncontracted.	*Contracted.*
Pos.	*πορφύρ-εος*, purple.	*πορφυρ-οῦς.*
Comp.	*πορφυρ-εώ-τερος.*	*πορφυρ-ώ-τερος.*
Super.	*πορφυρ-εώ-τατος.*	*πορφυρ-ώ-τατος.*

The ensuing four adjectives in *-αιος* (stem *αιο-*)—namely, *γεραιός*, *old*; *παλαιός*, *of old*, *ancient*; *περαιος*, *belonging to the other side* (of the river); *σχολαῖος*, *idle*—appear to drop the final *ο* of the stem: *e.g.*—

Positive.	*Stem.*	*Comparative.*	*Superlative.*
γεραιός.	*(γεραιο-)*	*γεραί-τερος.*	*γεραί-τατος.*

(Note that *φίλος*, *dear*, commonly has in the comparative *μᾶλλον φίλος*, and in the superlative *φίλτατος*.)

The following adjectives in *-ος*—namely, *εὔδιος*, *fair* (weather); *ἥσυχος* [*ὁ* and *ἡ*], *quiet*; *ἴσος*, *like*; *παραπλήσιος*, *similar*; *ὄρθριος*, *early* (in the morning); *ὄψιος*, *late*; *πρῴος*, *in the dawn*—appear to change the *ο* of the stem into *αι*, so that the comparative and superlative exactly correspond to the forms of the preceding: as—

Positive.	*Stem.*	*Comparative.*	*Superlative.*
μέσος, middle.	*(μεσο-)*	*μεσαί-τερος.*	*μεσαί-τατος.*

(*b*) -Υ, -Ν, -Ρ, -Σ **stems**:—

Positive.	*Stem.*	*Comparative.*	*Superlative.*
γλυκύς, sweet.	*(γλυκυ-)*	*γλυκύ-τερος.*	*γλυκύ-τατος.*
μέλας, black.	*(μελαν-)*	*μελάν-τερος.*	*μελάν-τατος.*
μάκαρ, blessed.	*(μακαρ-)*	*μακάρ-τερος.*	*μακάρ-τατος.*
ἀληθής, true.	*(ἀληθες-)*	*ἀληθέσ-τερος.*	*ἀληθέσ-τατος.*
πενής, poor.	*(πενες-)*	*πενέσ-τερος.*	*πενέσ-τατος.*

(*c*) **Stems in** -ON (and a few others) appear to add *-ες* (*-ις*) to the stem: *e.g.*, *εὐδαίμων* (stem *-ον*), *fortunate*, *happy*; *ἅρπαξ*, *rapacious*. Thus:—

Positive	*Stem.*	*Comparative.*	*Superlative.*
εὐδαιμων.	(εὐδαιμον-)	εὐδαιμον-έσ-τερος.	εὐδαιμον-έσ-τατος.
ἅρπαξ.	(ἅρπᾰγ-)	ἁρπαγ-ίσ-τερος.	ἁρπαγ-ίσ-τατος.

The adjectives in *-εις*, *-εν*, whose stem ends in *-ντ*, append the terminations *-τερος* and *-τατος* immediately to the stem; but in the coming together of two *τ*'s, the first changes into *σ*, whereon the foregoing *ν* is dropped:—

Positive.	*Stem.*	*Comparative.*		*Superlative.*
χαρίεις, graceful.	(χαριεντ-)	[χαριέντ-τερος] [χαριέν-τερος]	χαριέσ-τερος.	χαριέσ-τατος.

So, also, two adjectives in *-ος* (namely, *ἐρρωμένος*, *strong*, and *ἄκρᾱτος*, *unmixed*) append the connecting syllable *εσ* to the stem: as, *ἐρρωμεν-έσ-τερος*, *ἐρρωμεν-έσ-τατος*; *ἀκρατ-έσ-τερος*, *ἀκρατ-έσ-τατος*. So *αἰδοῖος*, *-α*, *-ον*, *modest*, has in the superlative *αἰδοι-έσ-τατος*.

The following four adjectives in *-ος* (namely, *λάλος*, *talkative*; *μονόφαγος*, *eating alone*; *ὀψόφαγος*, *fond of good eating*; and *πτῶχος*, *poor*, *begging*) change *ο* into *ισ*: as, *λάλ-ος*, *λαλ-ίσ-τερος*, *λαλ-ίσ-τατος*.

So contracted adjectives of two terminations change the *ο* of the stem into *εσ*: *e.g.*, *εὔνόος*, *εὔνοῦς*, *well-disposed*, stem *εὐνοο-*, comparative *εὐνο-έσ-τερος* = *εὐνούστερος*, superlative *εὐνο-έσ-τατος* = *εὐνούστατος*.

Adjectives in *-ης* (gen. *-ου*), after dropping the *ης*, take the connecting syllable *ισ*, as:—

Positive.	*Comparative.*	*Superlative.*
κλέπτ-ης, thievish.	*κλεπτ-ίς-τερος.*	*κλεπτ-ίσ-τατος.*

So also one in *-ης* of the third declension—namely, *ψευδής*, *-ές* (gen. *-έος*, *-οῦς*), *false*—makes *ψευδίστερος*, *ψευδίστατος*.

VOCABULARY.

'Αγάλλω, I adorn; in the middle voice with the dative, I am proud of.
Αἱρετός, *-ή*, *-όν*, chosen.
'Αριστείδης, *-ου*, *ὁ*, Aristides.
Βίαιος, *-α*, *-ον*, violent.
Δίκαιος, *-α*, *-ον*, just.
Ἔθνος, *-ους*, *τὸ*, a people, nation.
Ἰνδος, *-ου*, *ὁ*, Indian.
Καλλίας, *-ου*, *ὁ*, Callias (a proper name).
Κύκλωψ, *-ωπος*, *ὁ*, Cyclops.
Λακεδαιμόνιος, *-ου*, *ὁ*, a Lacedæmonian.
Νομίζω (*νομος*), I think, I hold as customary.
Οὐδείς, *-ένος*, no one; *ουδέν*, nothing.
Πατρίς, *-ίδος*, *ἡ*, one's mother country.
Σιωπή, *-ῆς*, *ἡ*, silence.
Σπαρτιατικός, *-ή*, *-όν*, Spartan.
Τίμιος, *-α*, *-ον*, honoured, esteemed, valuable.
Χρήσιμος, *-η*, *-ον*, useful.

The English adverb of comparison *than* is represented by *ἤ* (Latin *quam*), with the same case after as before it; thus, *the son is wiser than the father*, is in Greek *ὁ υἱὸς σοφώτερός ἐστιν ἢ ὁ πατήρ*. Another form of comparison is to omit the *ἤ* and to put the second noun in the genitive, as *ὁ υἱὸς σοφώτερος τοῦ πατρός ἐστιν*.

EXERCISE 49.

Translate into English:—

1. *'Αριστείδης πτωχίστατος ἦν, ἀλλὰ δικαιότατος.* 2. *Οἱ Κύκλωπες βιαιότατοι ἦσαν.* 3. *Καλλίας πλουσιώτατος ἦν 'Αθηναίων.* 4. *Οὐδὲν σιωπῆς ἐστι χρησιμώτερον.* 5. *Σιγή ποτ' ἐστὶν αἱρετωτέρα λόγου.* 6. *Οὐδέν ἐστι σοφίας τιμιώτερον.* 7. *Σοφία πλούτου κτῆμα τιμιώτερόν ἐστιν.* 8. *'Η Λακεδαιμονίων δίαιτα ἦν ἁπλουστάτη.* 9. *Οἱ γεραίτεροι ταῖς τῶν νέων τιμαῖς ἀγάλλονται.* 10. *'Η πατρὶς τοῖς ἀνθρώποις φιλτάτη ἐστίν.* 11. *Οἱ Ἰνδοι παλαίτατον ἔθνος νομίζονται.* 12. *Ὦ παῖδες, ἔστε ἡσυχαίτατοι.* 13. *Οἱ Σπαρτιατικοὶ νεανίαι ἐρρωμενέστεροι ἦσαν τῶν 'Αθηναίων.* 14. *Πολλοὶ τῶν χελιδόνων εἰσὶ λαλίστεροι.* 15. *Οἱ δοῦλοι πολλάκις ψευδίστατοι καὶ κλεπτίστατοί εἰσιν.*

EXERCISE 50.

Translate into Greek:—

1. The father is wiser than the son. 2. The mother is more talkative than the daughter. 3. Virtue is a most valuable possession. 4. Socrates was the wisest Athenian. 5. The Athenians were wiser than the Lacedæmonians. 6. No one of the

ancient Greeks was wiser than Aristides. 7. Men are quieter than boys. 8. The Lacedæmonians were very strong. 9. Swallows are very chattering. 10. The raven is very thievish. 11. Socrates' manner of life was very simple.

Compounds of χάρις interpose ω, as :—

Positive, ἐπίχαρις, -ι. (Gen. ἐπιχάριτ-ος, pleasing.)
Compar. ἐπιχαριτ-ώ-τερος. *Superl*. ἐπιχαριτ-ώ-τατος.

VOCABULARY.

Αἴτνη, -ης, ἡ, Ætna.
Αἶψα, suddenly.
'Ασθενής, -ές, powerless, weak.
'Ατυχία, -ας, ἡ, misfortune.
Αφροδίτη, -ης, ἡ, Aphrodite (Venus).
Βαθύς, -εια, -υ, deep.
Βαρύς, -εια, -υ, heavy, burdensome.
'Εγκρατής, -ες, self-controlled, abstinent.
Εὐσεβής, -ες, pious.
Εὔχαρις, -ι (gen. -ῐτος), attractive.
"Ηβη, -ης, ἡ, youth.
Κριτίας, -ου, ὁ, Critias.
Μεσότης, -ητος, ἡ, the middle, moderation.
Νόημα, -ᾰτος, τὸ, a thought (something in the νοῦς, mind).
'Ορθός, -ή, -όν, straight, right.
'Ορμή, -ῆς, ἡ, impulse, eagerness, zeal.
Οὐδέ, nor, not even.
Παρέρχομαι, I pass by.
Πρέσβυς, ὁ [the only cases besides the nominative are accusative πρέσβυν and vocative πρέσβυ; in the plural, πρέσβεις], old, an old man.
'Ωκύς, -εια, -υ, swift.

EXERCISE 51.

Translate into English :—

1. Αἶψα, ὡς νόημα, παρέρχεται ἥβη, οὐδ' ἵππων ὁρμὴ γίγνεται ταχυτέρα. 2. Τὸ γῆρας βαρύτερόν ἐστιν Αἴτνης. 3. 'Ο θάνατος τῷ βαθυτάτῳ ὕπνῳ παραπλησιώτατός ἐστιν. 4. Οἱ νέοι τοῖς τῶν πρεσβυτέρων ἐπαίνοις χαίρουσιν. 5. Φιλίας δικαίας κτῆσίς ἐστιν ἀσφαλεστάτη. 6. 'Η μεσότης ἐν πᾶσιν ἀσφαλεστέρα ἐστίν. 7. Οἱ γέροντες ἀσθενέστεροί εἰσι τῶν νέων. 8. Βουλῆς ὀρθῆς οὐδέν ἐστιν ἀσφαλέστερον. 9. Οἱ κόρακες μελάντατοί εἰσιν. 10. Σωκράτης ἐγκρατέστατος ἦν καὶ σωφρονέστατος. 11. 'Εν ταῖς ἀτυχίαις πολλάκις οἱ ἄνθρωποι σωφρονέστεροί εἰσιν ἢ ἐν ταῖς εὐτυχίαις. 12. Κριτίας ἦν ἁρπαγίστατος. 13. 'Αφροδίτη ἦν χαριεστάτη πασῶν θεῶν.

EXERCISE 52.

Translate into Greek :—

1. Old age is very burdensome. 2. Nothing is swifter than thought. 3. Moderation is the safest. 4. No bird is blacker than the raven. 5. The boy is swift, the man is swifter, the horse is swiftest. 6. Youth is more attractive than old age. 7. The Ethiopians are very black. 8. No one of the Athenians was more self-controlled than Socrates. 9. Critias was more given to plunder than Alexander. 10. Nothing is more pleasing than beautiful flowers.

KEY TO EXERCISES

Ex. 35.—1. The fishes rise up out of the river. 2. The hunters catch wild boars. 3. All were like corpses. 4. God rules our souls. 5. The vine brings forth grapes. 6. The earth brings forth ears of corn and grapes. 7. The mice fought once with the frogs. 8. The mice are caught in traps. 9. The Syrians worship fishes as gods. 10. We catch fishes with a hook.

Ex. 36.—1. 'Αγκίστροις ἀγρεύομεν τοὺς ἰχθῦς. 2. Οἱ ἰχθύες ἀγρεύονται ἀγκίστροις. 3. 'Ο θηρευτὴς ἐνεδρεύει τοὺς ἀγρίους σύας. 4. Οἱ βότρυες καὶ οἱ σταχυές εἰσι καλοί. 5. Ἄμπελος φέρει βότρυας. 6. Τοῖς βατράχοις ποτὲ ἦν μάχη πρὸς τοὺς μύας. 7. Προσβλέπομεν τοὺς νέκυας. 8. 'Η γῆ φέρει πολλὰς ἀμπέλους.

Ex. 37.—1. Wantonness produces outrage. 2. Many are our comrades in eating and drinking, but few in a good work. 3. Wealth sets men free from scarcity and want. 4. Follow your nature. 5. The passions of the body produce wars, and insurrections, and battles. 6. The magistrates are the guardians of the laws in a city. 7. O citizens, keep away from seditions. 8. O men, desire good deeds. 9. The natures of men differ. 10. Many evils spring from arrogance. 11. The gifts of a bad man bring no gain. 12. Character and wealth without wisdom are not safe possessions. 13. The fruits of the fig-tree are sweet. 14. The possessions of virtue alone are secure. 15. Many cities have walls. 16. The towers of the city are strong. 17. The towers are an ornament to the city.

Ex. 38.—1. 'Ο πλοῦτος λύει σπάνιν. 2. Ἡμῖν εἰσι φίλοι ἐν πόσει καὶ βρώσει, ἀλλ' οὐκ ἐν τοῖς κακοῖς. 3. 'Εν τῇ πόλει ὁ βασιλεύς ἐστι φύλαξ τῶν νόμων. 4. Πίθου, ὦ νεανία, τοῖς ἐν τέλει. 5. Ὦ παῖ, ὀρέγου τῶν καλῶν. 6. Κτῆσις τῆς ἀρετῆς ἐστι μόνη βεβαία. 7. Τῷ ἄστει εἰσὶ πολλοὶ πύργοι. 8. 'Αγαθοὶ νόμοι φέρουσιν τιμὴν τῷ ἄστει. 9. Ἕπου τῇ φύσει. 10. Οἱ στρατιῶται μάχονται ἐπὶ τῇ σωτηρίᾳ τῆς πόλεως. 11. Ὦ πολῖτα, φεῦγε στάσιν.

Ex. 39.—1. Kings have a care for their subjects. 2. The flock follows its shepherd. 3. Hector is slaughtered by Achilles. 4. The priests sacrifice oxen to the gods. 5. Cyrus was the son of good parents. 6. The ungrateful dishonour their parents. 7. My son, obey your parents. 8. Telemachus was the son of Ulysses. 9. Be willing to honour your parents before everything. 10. The idle tales of old women wear away (weary) the ears. 11. You rule gloriously, O king. 12. Old women are very talkative. 13. Shepherds drive the flock of cattle to pasture. 14. Homer likens the eyes of Juno to those of an ox. 15. Patroclus was the friend of Achilles. 16. We admire Cyrus, the king of the Persians, because of his virtue as well as his wisdom.

Ex. 40.—1. Αἱ ἀγέλαι ἕπονται τῷ νομεῖ. 2. 'Ο ἄναξ ἔχει ἐπιμέλειαν τοῦ πολίτου. 3. Τὰ ὦτα τείρεται λήρῳ τῶν γραῶν. 4. 'Η γραῦς ἐστι πολύλογος. 5. 'Ο ποιμὴν ἄγει τὴν ἀγέλην τῶν βοῶν πρὸς τὴν πόλιν. 6. Βόες θύονται τοῖς θεοῖς ὑπὸ τῶν ἱερέων. 7. Οἱ γονεῖς στέργονται ὑπὸ τῶν τέκνων. 8. 'Αγαθοῦ ἐστι ποιμένος ἔχειν ἐπιμέλειαν τῶν ἀγελῶν.

Ex. 41.—1. Homer sings of many heroes. 2. We admire the valour of the heroes. 3. The slaves lead a sad life. 4. The garden of the uncle is fine. 5. O child, be desirous of modesty. 6. Modesty follows good men. 7. We admire Lysias for his persuasiveness and grace. 8. Reverence is implied in modesty. 9. Do not look at the face of Gorgon. 10. O Echo, often thou deceivest men. 11. All men aim at prosperity. 12. It is becoming for a child and a young man to be modest. 13. Clio and Erato are muses.

Ex. 42.—1. Ὅμηρος ᾄδει 'Αχιλλῆ τὸν ἥρωα. 2. 'Αχιλλεὺς ὁ ἥρως ᾄδεται ὑπο 'Ομήρου. 3. 'Η ἀρετὴ τοῦ ἥρωός ἐστι θαυμαστή. 4. Θαυμάζομεν τὴν ἀρετὴν τῶν ἡρώων. 5. Τοῖς δμωσίν ἐστι βίος λυπηρός. 6. Πάτρωί ἐστι κῆπος καλός. 7. Πάντες χαίρουσι τῃ εὐεστοῖ. 8. Θαύμαζε, ὦ παῖ, μετὰ τῆς αἰδοῦς τὰ πράγματα τῶν ἀγαθῶν. 9. Ἠχοῖ πολλάκις ψευδόμεθα.

Ex. 43.—1. Women rejoice in ornament. 2. The Greeks worship Zeus, and Poseidon, and Apollo, and other gods. 3. Modesty becomes women. 4. The dogs guard the house. 5. The pilot directs the ship. 6. The droppings of water make the rock hollow. 7. It is a woman's duty to watch her home. 8. It is the part of a good wife to keep house. 9. The dice of Jove always throw luckily. 10. Dogs afford men aid and pleasure. 11. The evidence of witnesses is often unreliable. 12. Carry, my child, the key of the chest. 13. O Zeus, receive the prayers of the unfortunate man. 14. Castor and Pollux were the saviours of ships. 15. Silence brings honour to every woman. 16. The Æthiopians have dark hair. 17. Lady, keep safe your house. 18. We comb our hair with a comb. 19. Æăcus keeps the keys of Hades.

Ex. 44.—1. Κόσμος πρέπει τῇ γυναικι. 2. Ἔργον ἐστὶ γυναικῶν φυλάττειν τὴν οἰκίαν. 3. Φέρουσι κλεῖς τῆς οἰκιας. 4. Κλεῖδες τῆς οἰκίας φέρονται τῇ μητρι. 5. Τοῖς Ἀθηναιοις ἦσαν πολλαὶ νῆες. 6. Διί ἦσαν πολλοὶ νεῴ. 7. Οἱ ἴχθυες ἀνακύπτουσιν ἐκ τοῦ ὕδατος. 8. Ὁ κυβερνήτης ἰθύνει τὴν ναῦν. 9. Ἡ ναῦς ἰθύνεται ὑπὸ τοῦ κυβερνητου. 10. Σεβεις Δια καὶ Ἀπολλω.

Ex. 45.—1. To drink much wine is an evil. 2. Kings have large revenues. 3. In Egypt is abundance of corn. 4. The sea is great. 5. Crœsus had great wealth. 6. From a slight joy often arises great anguish. 7. To gentle words we yield with pleasure. 8. The great gifts of fortune bring terror. 9. The tempers of many men are gentle. 10 Toil is a great aid to virtue. 11. Children love gentle fathers and gentle mothers. 12. Keep up an acquaintance (have intercourse) with gentle-hearted men. 13. The women are gentle 14. The majority of mankind call Alexander, King of Macedonia, Great.

Ex. 46.—1. Ἀπέχου πολλοῦ οἴνου. 2. Οἱ κακοὶ χαίρουσι πολλῷ οἰνῳ. 3. Πολὺς οἶνος βλάπτει τοὺς ἀνθρώπους. 4. Τοῖς βασιλεῦσίν εἰσι μεγάλαι πρόσοδοι. 5. Ἡ προσοδος τῶν βασιλέων ἐστὶ μεγάλη. 6. Αἴγυπτος ἔχει πολὺν σῖτον. 7. Πολλοῖς ἐστι πολὺς πλοῦτος, ὀλιγος δὲ νοῦς. 8. Ὀρεγεσθε πραέων ἐθέων. 9. Τὰ ἔθη τῶν γυναικῶν ἐστι πραέα. 10. Κάλλος ἐστὶ πραέσι ἔθεσι. 11. Ἀλέξανδρος, ὁ τῶν Μακεδόνων Βασιλεύς, πολλάκις μεγας προσαγορευεται.

SKETCHING FROM NATURE.—II.

[*Continued from p.* 20.]

POINT OF SIGHT.

It is not a difficult matter to determine *precisely* where the *point of sight* is to be found. If the pupil will do as we recommended in the last lesson—that is, hold his pencil between his eye and one of the upper retiring lines, say the eaves, so that the line of the eaves shall coincide with, or be made apparently to lie upon the length of the pencil, and when thus placed, carry his eye downwards along the pencil until it comes to the line of sight—he will find the pencil directed to the *point* opposite the eye. This can be proved by placing the pencil upon another line which is parallel to the eaves, say the foundation line of the wall; the pencil thus placed will point in the same direction, and it would do the same if it be made to coincide with the tops of the doors, or with any other lines that may be parallel with them. There is another way of proving that the point of sight is the vanishing point for lines going off at a right angle with our position: if we hold out our arm horizontally, and place it in a parallel position with the retiring side of the street, we shall find we are *pointing to the point of sight*. Let the pupil try this, which he can do in a room if he places himself in such a position, that on looking before him the direction of sight shall be parallel to the sides of the room on the right hand and the left. We shall have to refer to this again when we place ourselves before a subject in which there is a building having an *angle* towards us, and *not a side*.

The first line that the pupil must mark in (we do not advise him to *draw* any lines until he has first determined the places of all the principal ones) will be the one nearest the PS. Let this be the course of procedure in all cases, that is, when arranging the positions of the lines *he must begin from the point of sight*, and as he passes on, if to the right, mark the place for each line which crosses the line of sight as he comes to it, then take up those lines on the left, commencing from the PS, and treat them in the same way; then he must determine the heights of the perpendicular lines drawn through these points of position. He must exercise his judgment in this matter by the comparison of widths and heights in the original.

OBJECTS WITH RETIRING SIDES, ETC.

The instructions we gave in the last lesson referred to the treatment of a subject when placed in a *parallel* position with ourselves, or with the picture plane; we then endeavoured to show that we must be guided by the rules of *parallel* perspective when intending to draw an object in this position. It will be unnecessary to say more upon this subject, beyond recommending our pupils to turn back to lessons in Drawing, No. II., Vol. I., page 70. The remarks we there made, in conjunction with all that we have recently explained, will, we have no doubt, make the process sufficiently clear to the student.

Having given these directions, we will now suppose ourselves to be placed before a subject *having an angle presented to us;* in other words, *all its sides retiring*. In this case we must be guided solely by the rules of *angular* perspective. Here, once more we advise our pupils to refer to the instructions upon Angular Perspective in lessons in Drawing, No. II., Vol. I., page 70.

After this there will be no difficulty in understanding that a building in *parallel* perspective can have but *one* position; whilst one in *angular* perspective may have many, according to the *angle of inclination* the side of the building may form with the picture plane or with our position. Now, before we begin to make our drawing of the subject we are supposed to have before us, we must direct the attention of our pupils to a few remarks respecting the relation there exists between the object itself and the picture they are about to make of it. We undertake this, with the hope that it will give them a clear idea of what we mean by the expression just used, "our position," as it is so essentially necessary to understand this term in connection with angular perspective. In considering this there is one condition which we doubt not will be admitted by all—that the outline of a subject, let it be composed of houses, trees, or anything else, ought to be so correct in the drawing that if we held the paper up before us, between the objects and the eye (supposing the paper to be transparent), we should find that each line in the drawing would coincide with the corresponding line of the object drawn. To do this exactly, or even to make an approximation to it, would indeed prove the ability of the draughtsman to be very great; and although to some of our pupils this view of the question may seem somewhat strange, yet a little consideration will quickly put aside all doubts that may arise as to the reasonableness of it; and if the meaning it conveys be rightly understood, we shall have got over half the difficulty in comprehending the meaning of the term "our position."

When we are drawing any subject from nature, we are supposed to be standing on an imaginary line which goes off directly on our right hand and on our left, and therefore neither advances nor retreats in its direction. Having thus placed ourselves, we must look directly before us; consequently, the way we are looking, which we will call *the direction of sight*, will form right angles with this imaginary line upon which we are supposed to stand. *Now this imaginary line indicates our position*, and if we were engaged in tracing a landscape from nature upon a piece of glass (which would be the picture plane), that glass or picture would necessarily be placed *parallel to this imaginary line that marks our position:* therefore whatever line in nature is found to be perpendicular to the *picture plane* would be perpendicular to the *line of position* also; and similarly, any line of the object which formed an angle with the one would in like manner form an angle with the other. It will be seen how the picture plane is situated with regard to the eye, E. It is parallel with our position when we stand before it and look directly towards it, and when a line from the eye E to the surface of the picture will form right angles with the picture plane, as the line E PS with HL. Well, then, admitting this to be the case, we can understand that if a line in the object is so placed that each end is equidistant from the picture plane (that is, parallel with it), we have nothing more to do than draw it across the paper; it has no vanishing point; but when the line has one end *nearer* to the eye than the other, it then retires and is at an angle *both with our position and the picture plane:* all lines similar to this *must have their vanishing points.*

After the above remarks, we now come to the object of the present lesson, namely to give some general directions to our pupils *how they are to proceed when they are drawing retiring lines from nature.*

The rule in Geometrical Perspective for finding a vanishing point is, "Draw a line from the station point parallel to the ground plan as far as the picture plane." When drawing from nature, our practice must be founded upon this regulation when we desire to determine the vanishing points for the retiring lines of buildings or other regular objects at whatever angle they may appear before us; all of which can very easily be done without the necessity of making a plan of the subject, even were that possible. We recommend the practice of a few very simple problems in Geometrical Perspective; for we can testify how much this branch of art prepares the mind of the student of nature to perceive facts which might otherwise be lost to him. It gives him confidence in placing his lines, and the proportions of the whole and parts of objects, so that when a doubt arises he has a means at hand to dispel it; therefore we urge those of our pupils whose only desire is to draw from nature without having any intention to pursue any branch of art in which geometrical drawing is indispensable, not to neglect the advantages a little geometrical knowledge affords, as we know from long experience how it imparts a readiness and certainty in drawing lines which in thousands of hands would run wild without its guidance. Upon the same principle we should, in Geometrical Perspective, "draw a line from the station point parallel with the ground plan": so in like manner the student, when standing before his subject, should hold up his arm horizontally and *parallel with the retiring side of the building* he is about to draw; and if he then looks in the direction of his arm, he will find he is *pointing to the vanishing point*, which probably may be marked by some conspicuous object in the distance, perhaps a particular tree or cottage, which he must fix as a vanishing point. He must then hold up his pencil at arm's length, and horizontally between his eye and the building, and measure its length on the pencil, then see how many of these lengths will be repeated between the end of the building and the object which had been previously marked as the vanishing point. We will suppose it is repeated twice: he must then commence by drawing the horizontal line, and then decide upon the size of the building, or the space he intends to occupy in his drawing; say from *a* to *b* (Fig. 3). Repeat that space twice on the HL, first to *c* and then to *e*, which will be the vanishing point for all the parallel and horizontal retiring lines upon that side of the building. The same practice must be observed for the retiring end of the building: the arm must be extended in a parallel direction to it, the point fixed upon, and the building measured on the pencil as before, and the distance repeated till it reaches the object the arm pointed at. (*See* Fig. 3, where it is repeated once and a half, first at *d* and the half at *f*, the object pointed at.) If we place ourselves further away from the building, its measured length would be repeated oftener to reach the VP. For an explanation of this see the remarks upon Fig. 39, lessons in Drawing, Vol. I., page 222. Another method, or substitute for holding out the arm to find the VP, is to place the pencil or a long ruler between the eye and upon or coinciding with the retiring lines. Those lines which are above the eye or HL will incline *downwards*, those below the eye will incline *upwards, all meeting at the same vanishing point.* (See lessons in Drawing, No. II., Vol. I., page 70, explanation of the VP.) Suppose we are about to draw the church (Fig. 4). As we are obliged to sit near to it, we are compelled to make the point of sight at *a* in order to bring the whole subject within the angle of vision, 60°, and consequently make it a case of *angular* perspective. If we could have sat further away from it, we might have made it a case of parallel perspective, and have fixed the point of sight at the VP of the end of the building. Under the present circumstances, if we hold out the arm parallel to the end of the building, we shall be pointing to the tree as the VP; this would be the vanishing point also for the parallel retiring lines of the porch. The ridge of the roof and all lines parallel with it would retire in the other direction, but being at a very small angle with the picture plane or with our position, they would meet the horizontal line at some distance out of the picture, so that it would be impossible to place the vanishing point within the paper; therefore we must hold up the pencil horizontally between the eye and the roof, like the line *b c*, by which we ascertain the proportion of the inclination.

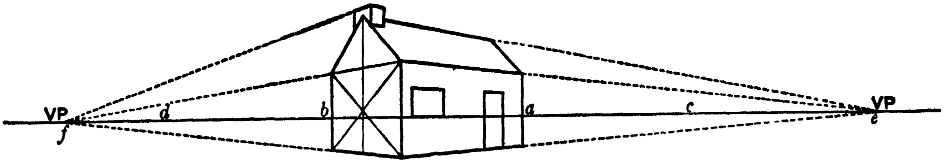


Fig 3.

It is a very difficult task to give a written explanation of all that is to be observed when drawing from nature. The broad practical rules we have laid down we know to be simple in themselves, and we have endeavoured to make our explanations equally so, hoping very few of our pupils will fail to understand them, as we have written under a supposition that the problems in Geometrical Perspective in these pages have been studied, because through a knowledge of them many and great difficulties will be rendered easy and our explanations intelligible. If the eye only is to be depended upon, as some maintain, what need is there for any assistance at all, either from written instructions or from the lips of a master? As we have said before, there is not a line in nature but is subject to some special rule for its representation; and unless the rule has been the guide for placing it, without fail that rule will become its judge to condemn it.

We must now say something upon the theory, and offer our pupils some advice upon the course they must pursue amongst the difficulties they will find in the principles and application of the art. The rules we have given will help them over grammatical difficulties and assist them in the work of construction, and for these reasons they cannot be dispensed with; but they are incapable of giving those charms to a picture which it is the province of theory to impart, founded upon a right feeling for the beauties and effects of nature. Our pupils have now at their command a sufficient supply of geometrical information, as well as directions where to find it in these pages, and of which we hope and trust they will make a good use; it will prove to be the best and most solid foundation whereupon to build other principles to be derived from a close observation of nature, and from a careful study of the numerous works of our most eminent artists.

Enfants, je vais sortir; j'espère qu'*on* sera sage.	*Children, I am going out; I hope* you *will be good.*
Vous savez bien que *l'on* vous aime MOLIÈRE.	*You know well that* she *loves you.*

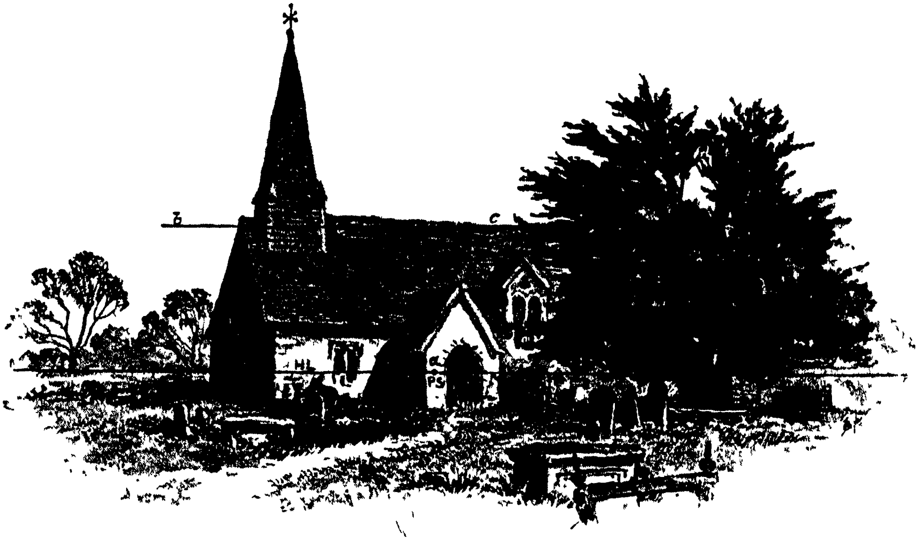


FIG. 4.

FRENCH.—XXXII.

[*Continued from p* 25]

THE INDEFINITE PRONOUN ON (*continued*).

IF the word *on* denotes definitely a female, the adjective relating to it takes the feminine termination :—

Quand *on* est *belle*, *on* ne l'ignore pas. L'ACADÉMIE	*When one (a lady) is handsome, she is not ignorant of it.*

The pronoun *on* must be repeated before every verb :—

On lève l'ancre, *on* part, *on* fuit loin de la terre. *On* découvrait déjà les bords de l'Angleterre. VOLTAIRE.	*They raise the anchor, they depart, they flee far from the land, already they discovered the shores of England*

Although *on* is invariably followed by a verb in the singular, yet the noun or adjective referring to it may be used in the plural :—

On est *amis* aujourd'hui, demain *on* est *rivaux*.	*People are friends to-day; to-morrow they will be rivals.*
On n'est pas *des esclaves* L'ACADÉMIE.	*We are not slaves.*
Ici *on* est *égaux* (speaking of a cemetery). LITTRÉ.	*Here people are equal.*

In familiar conversation, even in writing, *on* is frequently used instead of any of the personal pronouns :—

Il y a un siècle qu'*on* ne vous a vu.	I *have not seen you for an age.*
Soyez tranquille, *on* s'occupera de votre affaire.	*Be easy,* we *will attend to your business.*

The verb and the other parts of speech have already been dealt with at such length that it is unnecessary that we should devote further space to them. Were we to ask you to occupy yourselves once more with them, we could merely repeat what we have already said. But if, now that you have renewed your acquaintance with the pronouns and their idioms, you find that your knowledge of the verbs is growing rusty, it will be doubtless worth your while to re-read the previous lessons, in which the verbs were discussed, before proceeding further.

COLLOCATION OF WORDS

The place of the different parts of speech has been mentioned in the Syntax under their several heads, and in various other parts of the work. A summary of the principal rules of construction may not, however, be unacceptable here.

The collocation of words is the order according to which the several words which form a sentence should follow one another. This order is fixed for the several forms of sentences, affirmative, negative, and interrogative, by the genius of the language, and the practice of the best writers.

When the order in English differs from the order in French in the following examples, it will be well if you write down or at least make clear to your own mind the correct order of the English words.

The construction of the affirmative sentence is as simple in French as it is in English. The following is the arrangement of the words:—

1. *Subject.*	2. *Verb.*	3. *Adverb.*
Le marchand	est	ici.
The merchant	*is*	*here.*

When the subject is accompanied by an adjective, or another attribute, the order is as follows:—

1. *Subject.*	2. *Attribute.*	3. *Verb.*	4. *Adverb.*
Le marchand	anglais	est	ici.
The merchant	*English*	*is*	*here.*
Le fils	de votre ami	est	là.
The son	*of your friend*	*is*	*there.*
Le marteau	de fer	est	ici.
The hammer	*of iron*	*is*	*here.*
Le bateau	à vapeur	est	là.
The boat	*steam-*	*is*	*there.*

When the attribute of the subject is placed in apposition to the verb, the construction is the same in the two languages:—

1. *Subject.*	2. *Verb.*	3. *Attribute.*
Le marchand	est	anglais.
The merchant	*is*	*English.*

When the verb is in a compound tense, many adverbs are placed between the auxiliary and the participle:—

1. *Subj.*	2. *Auxiliary.*	3. *Adv.*	4. *Participle.*
Nous	avons	souvent	lu.
We	*have*	*often*	*read.*

Long adverbs of manner ending in *-ment*, other long adverbs, and the adverbs of time and place, ***aujourd'hui***, ***demain***, ***hier***, *ici*, *là*, are not placed between the auxiliary and the participle:—

Nous avons écrit aujourd'hui.	*We have written to-day.*

When there is a direct object in the sentence, it is placed after the verb:—

1. *Subj.*	2. *Attribute.*	3. *Verb.*	4. *Adv.*	5. *Dir. Obj.*
L'ecolier	attentif	apprend	toujours	sa leçon.
The scholar	*attentive*	*learns*	*always*	*his lesson.*

When there are two objects of equal length, or nearly so, the direct precedes the indirect:—

1. *Subj.*	2. *Verb.*	3. *Dir. Obj.*	4. *Indir. Obj.*
Jean	a donné	le livre	a mon père.
John	*has given*	*the book*	*to my father.*

Should the direct object be followed by a relative pronoun, or by attributes rendering it longer than the indirect object, the latter is placed first:—

1. *Subj.*	2. *Verb.*	3. *Indir. Obj.*	4. *Dir. Obj.*
Jean	a donne	à mon père	le livre qu'il lui avait promis.
John	*has given*	*to my father*	*the book which he had promised him.*

The pronouns representing the direct object, and those representing the indirect object preceded by *to* expressed or understood in English, are placed before the verb in French:—

1. *Subj.*	2. *Dir. Obj.*	3. *Verb.*
Nous	les	voyons.
We	*them*	*see.*

1. *Subj.*	2. *Indir. Obj.*	3. *Verb.*
Nous	leur	parlons.
We	*to them*	*speak.*

In the imperative used affirmatively, those pronouns follow the verb:—

1. *Verb.*	2. *Dir. Obj.*	1. *Verb.*	2. *Indir. Obj.*
Voyez-	les.	Parlez-	leur.
See	*them.*	*Speak*	*to them.*

When two personal pronouns are used as objects in a sentence, the indirect, if in the first or second person, precedes the direct:—

1. *Subj.*	2. *Indir. Obj.*	3. *Dir. Obj.*	4. *Verb.*
Paul	nous	le	donne.
Paul	*to us*	*it*	*gives.*
Paul	vous	le	donne.
Paul	*to you*	*it*	*gives.*

Should, however, the indirect and the direct objects be in the third person, the indirect is placed after the direct:—

1. *Subj.*	2. *Dir. Obj.*	3. *Indir. Obj.*	4. *Verb.*
Paul	le	lui	donne.
Paul	*it*	*to him*	*gives.*

In the imperative used affirmatively, the direct object always precedes the indirect:—

1. *Verb.*	2. *Dir. Obj.*	3. *Indir. Obj.*
Donnez-	les	nous.
Give	*them*	*to us.*
Donnez-	les	lui.
Give	*them*	*to him.*

The pronoun representing a noun in an oblique case generally preceded in English by a preposition other than *to* is in French placed after the verb:—

1. *Subj.*	2. *Verb.*	3. *Indir. Obj.*
Je	parle	de lui.
I	*speak*	*of him.*
Je	parle	avec lui
I	*speak*	*with him.*

To render a sentence negative, *ne* is placed immediately before the verb, and *pas*, *jamais*, *rien*, etc., after it:—

1. *Subj.*	2. *Neg.*	3. *Verb.*	4. *Neg.*
Je	ne	vois	pas.
I	*not*	*see*	*not.*
Je	ne	lis	jamais.
I	*not*	*read*	*never.*

When the verb is in a compound tense, the first negative is placed before the auxiliary, and the second between that auxiliary and the participle:—

1. *Subj.*	2. *Neg.*	3. *Obj.*	4. *Aux.*	5. *Neg.*	6. *Part.*
Je	ne	l'	ai	pas	vu.
I	*not*	*him*	*have*	*not*	*seen.*
Je	ne	leur	ai	jamais	parlé.
I	*not*	*to them*	*have*	*never*	*spoken.*
Je	ne	leur	ai	rien	donné.
I	*not*	*to them*	*have*	*nothing*	*given.*

The pronouns used as direct and indirect objects are placed before the imperative, used negatively:—

1. *Neg.*	2. *Obj.*	3. *Obj.*	4. *Verb.*	5. *Neg.*
Ne	nous	le	donnez	pas.
Not	*to us*	*it*	*give*	*not.*
Ne	le	lui	donnez	pas.
Not	*it*	*to him*	*give*	*not.*

The construction of an interrogative sentence which has a noun for its subject differs in the two languages. The following examples will show the order of the words in French:—

1. *Subj.*	2. *Verb.*	3. *Duplicate Subj.*	4. *Obj.*
Le marchand	reçoit-	il	son argent?
The merchant	*receives*	*he*	*his money?*
Mon frère	écrit-	il	des lettres?
My brother	*writes*	*he*	*letters?*

When the sentence commences with **où**, *where;* **que**, *what;* **quel**, *what*, *which;* **combien**, *how much*, *how many;* the noun may be placed after the verb:—

Où est votre *ami?*	*Where is your friend?*
Que dit votre *père?*	*What says your father?*

The construction of interrogative sentences in which the subject is a pronoun is very simple. The pronoun is placed after the verb in simple tenses, and after the auxiliary in compound tenses:—

1. *Indir. Obj.*	2. *Verb.*	3. *Subj.*	4. *Dir. Obj.*
Nous	envoyez-	vous	notre argent?
To us	*send*	*you*	*our money?*

1. *Indir. Obj.*	2. *Aux.*	3. *Subj.*	4. *Part.*	5. *Dir. Obj.*
Leur	avez-	vous	donné	cet argent?
To them	*have*	*you*	*given*	*that money?*

The order of the words in a sentence at once negative and interrogative is as follows:—

1. 1*st Neg.*	2. *Indir. Obj.*	3. *Verb.*	4. *Subj.*
Ne	nous	envoyez-	vous
Not	*to us*	*send*	*you*

5. 2*nd Neg.*	6. *Dir. Obj.*
pas	de l'argent?
not	*money?*

In a compound tense:—

1. 1*st Neg.*	2. *Indir. Obj.*	3. *Verb.*	4. *Subj.*
Ne	nous	avez-	vous
Not	*to us*	*have*	*you*

5. 2*nd Neg.*	6. *Participle.*	7. *Dir. Obj.*
pas	envoye	de l'argent?
not	*sent*	*money?*

The first person singular of the present of the indicative of most verbs which have in that person only one syllable, and of a few others having more than one syllable, seldom admit of the pronoun being placed after the verb. (*See* Vol. II., p. 117.) To render the sentence interrogative, *est-ce que* is prefixed to the affirmative form of the verb:—

Est-ce que je parle?
Is it that I speak?
Do I speak?
Est-ce que je prétends lui parler?
Is it that I pretend to speak to him?
Do I pretend to speak to him?

Every person of a tense susceptible of being conjugated interrogatively admits of this construction:—

Est-ce que vous lisez?	*Do you read?*
Est-ce que votre frère est arrivé?	*Is your brother arrived?*

In poetry and elevated prose, the subject of an affirmative sentence is sometimes placed after the verb:—

Tout à coup au jour vif et brillant de la zone torride, succede *une nuit* universelle et profonde; à la parure d'un printemps éternel, *la nudite* des plus tristes hivers. RAYNAL.	*Suddenly to the vivid and brilliant day of the torrid zone, succeeds a universal and profound night; to the attire of an eternal spring, the nakedness of the saddest winters.*

The article, the demonstrative, and the possessive adjective are repeated before every word that they determine.

Pronouns used as subjects of verbs may be repeated before every verb.

Pronouns used as objects must be repeated before every verb.

Prepositions are generally repeated before every word which they govern.

USE OF CAPITAL LETTERS.

The only important difference existing in the two languages in the use of capital letters is that the French do not use a capital for an adjective which signifies *belonging to a town or country*, unless it be used substantively, and in reference to persons, or unless it form an integral part of a name:—

Ce monsieur est-il *français?*	*Is that gentleman French?*
C'est un *Français.*	*He is a Frenchman.*
Est-il *français?*	*Is he French?*
Cette dame est-elle *anglaise?*	*Is that lady English?*
C'est une *Anglaise.*	*She is an English lady.*
Elle est *anglaise.*	*She is English.*
Apprenez-vous le *français?*	*Do you learn French?*
Je n'apprends pas l'*anglais.*	*I do not learn English.*
J'attends le *Français* qui demeure ici.	*I am waiting for the Frenchman who lives here.*
Le département des *Basses-Alpes.*	*The department of the Lower Alps.*
Le royaume des *Pays-Bas.*	*The kingdom of the Netherlands.*

ELISION.

Elision is the suppression of the final vowel of a word, and the substitution of an apostrophe (') before words commencing with a vowel or an *h* mute:—

The vowels thus elided are *a*, *e*, *i*:—

a is only elided in *la*, article or pronoun—**L'âme**, *the soul*, instead of *la âme;* **l'humilité**, *humility*, instead of *la humilité;* **je l'admire, je l'honore**, *I admire her*, *I honour her*, instead of *je la admire, je la honore.*

NOTE.—The *a* of *la*, pronoun, is elided only when it precedes its verb.

e is elided in *le*, article or pronoun, in *je*, *te*, *me*, *se*, *ce* (meaning *it*, dem. pron.), *de*, *ne*, *que*, *parce*, *que*, *quoique*, *puisque*, *jusque*, *quelque*, —**l'ami**, *the friend;* **l'homme**, *the man;* also in *presque* in the compound noun *presqu'île;* also in *entre* in compound words such as *entr'acte*, *s'entr'aider;* also in *grande* in feminine compound nouns: *grand'tante*, *grand'messe.*

NOTE.—The *e* of the pronouns *je*, *me*, *le*, and *ce* is elided only when they precede their verb.

i is only elided in *si* coming before **il**, *he*; **ils**, *they*.

Although the words *onze*, *onzième*, *oui*, *ouate*, *yatagan*, *yard*, *yacht*, *yoga*, *yole*, *yucca* commence with a vowel, the article is not elided before them.

This brings to an end our detailed study of the French language. There are still many difficulties for you to overcome. In order to render your task an easier one, we shall now set before you a list of idioms and help to remove one great stumbling-block from your path by giving you a full list of words which resemble one another in spelling or pronunciation, but differ in meaning. But first we must remind you that the French and English languages have an important element in common, and that there is a striking analogy between a large number of English and French words.

Analogy between English and French Words.

Most words ending in *-al*, *-ce*, *-de*, *-ge*, *-le*, *-ne*, *-ant*, *-ent*, *-ion*, are the same in both languages :—

-al	Minéral, général, animal, principal, fatal.
-ce	Race, prudence, notice, sacrifice, édifice.
-de	Parade, grade, ambuscade, parricide, prélude.
-ge	Courage, page, vestige, orange, déluge.
-le	Docile, capable, table, possible, fertile, ridicule.
-ne	Doctrine, mine, scène, famine, machine, héroine.
-ant	Dormant, vigilant, constant, instant, arrogant.
-ent	Présent, content, accident, président, résident.
-ion	Question, fraction, legion, pension, religion.

Most words ending in *-ary*, *-ory*, *-gy*, *-ncy*, *-ty*, *-ous*, *-or*, *-our*, *-ine*, *-ive*, become French by changing

-ary	into	**-aire**	Necessaire, militaire.
-ory	„	**-oire**	Mémoir, gloire, victoire.
-gy	„	**-gie**	Énergie, géologie, effigie.
-ncy	„	**-nce**	Clemence, décence, excellence, constance.
-ty	„	**-té**	Charité, beauté, divinité.
-ous	„	**-eux**	Industrieux, curieux, fameux.
-or, -our	„	**-eur**	Candeur, ardeur, acteur, docteur.
-ine	„	**-in**	Masculin, féminin, clandestin.
-ive	„	**-if**	Actif, passif, massif.

English feminine names ending in *a* finish in French in *e*; *Sophia*, **Sophie**.

If you master the above rules, you will start at once with a by no means contemptible vocabulary.

NOTE.—Students should not assume that because some French words are more or less similar in spelling to some English words, they are also similar in signification. This is far from being always the case.

Gallicisms or Idiomatic Phrases.

The greatest barriers which separate one language from another are its idioms. Gallicisms, or idioms peculiar to French, are very numerous in that language. We have already in the first part of these lessons presented a considerable number of such expressions, and will here give a somewhat extended list of those not placed in the examples and exercises. In proverbial sayings, we have endeavoured to give the equivalent English phrase. We would advise the student to analyse carefully the following idiomatic sentences, and particularly those which do not admit of a literal or near translation. Idioms and proverbial phrases give a great insight into the character and customs of a nation, and their analysis is often of great assistance in the acquisition of a language.

The following list cannot of course be committed to memory. A few idioms only should be learnt every day, and if the student be wise, he will practise turning them from English back into French, as well as from French into English :—

Ce piano n'est pas d'accord	*This piano is out of tune.*
Arrangez cette affaire a l'amiable.	*Settle that business amicably.*
Nous sommes d'accord sur ce point.	*We agree upon that point.*
Quel âge donneriez-vous à cet homme ?	*How old would you take that man to be ?*
Cela fera bien mon affaire.	*That will suit me exactly.*
Allons au fait.	*Let us come to the point.*
Vous mettez ma patience à bout.	*You exhaust my patience.*
Ce sont deux têtes dans un bonnet.	*They are both of the same mind.*
Vous avez toujours ces propos à la bouche.	*You always use those expressions.*
Entre nous soit dit, ce n'est pas la mer a boire.	*Between ourselves, the thing is not so very difficult.*
Vous ne savez plus de quel bois faire fleche.	*You are put to your last shift. You are at your wit's end.*
J avais ce mot sur le bout des levres.	*I had that word at the tip of my tongue.*
C'est son bras droit.	*He is his right hand.*
Il nous a fermé la porte au nez.	*He shut the door in our face.*
Vous allez toujours droit au but.	*You come always to the main point.*
En tout cas, je leur remettrai votre lettre.	*At all events, I will give them your letter.*
Ne voyez-vous pas qu'il rit sous cape ?	*Do you not see that he laughs in his sleeve ?*
Nous avons piqué des deux.	*We put spurs to our horses.*
Nous en sommes sur ce chapitre.	*We are speaking about this matter.*
Oh ! pour le coup, vous avez raison.	*Oh ! for this time you are right.*
Cet orateur bat la campagne.	*That speaker wanders from his subject.*
Parlez-moi à cœur ouvert.	*Speak to me without reserve, openly.*
Nous avons couché a la belle étoile.	*We slept in the open air.*
Je n'ai que faire de son argent.	*I do not want his money.*
J'ai fait si bien mon compte, que j'ai obtenu cet argent.	*I managed matters so well, that I obtained that money.*
Cela ne me fait rien du tout.	*That is nothing at all to me.*
Faites-moi grâce de tous ces détails.	*Spare me all those particulars.*
C'en est fait.	*It is all over. All is gone.*
Comme vous voilà fait !	*What a condition you are in !*
Il m'a prié de vous faire ses amitiés.	*He wished me to give his love to you.*
En attendant, faites-lui mes compliments.	*In the meanwhile, present my compliments to him.*
Chemin faisant, nous le rencontrâmes.	*Going along, we met him.*

Le plus fort est fait.	*The most difficult part is done.*
Ce soldat n'a jamais vu le feu.	*That soldier has never smelt gunpowder.*
Il s'est bien tiré d'affaire.	*He came off very well.*
Nous sommes au fort de l'hiver.	*We are in the depth of winter.*
Qu'allait-il faire dans cette galère ?	*What business had he there?*
C'est un homme comme il faut.	*He is a gentleman.*
Ce drap est hors de prix.	*That cloth is extravagantly dear.*
Il se fit jour à travers les ennemis.	*He forced his way through the enemy.*
Je vois cela dans un autre jour.	*I see that in a different light.*
Dites-moi au juste ce qu'il en est.	*Tell me exactly how the matter stands.*
Il ne laisse pas de dépenser beaucoup.	*He spends a great deal, nevertheless.*
C'est une autre paire de manches.	*That is quite another thing.*
C'est un tour de son métier.	*That is one of his tricks.*
Vous l'avez mis au pied du mur.	*You left him no excuse.*
Voilà qui va le mieux du monde.	*That is going on finely.*
Revenons à nos moutons.	*Let us resume our subject.*
Cela est d'un bon naturel.	*That bespeaks a good disposition.*
Ces arbustes grandissent à vue d'œil.	*Those shrubs grow visibly.*
Je regarde cela d'un autre œil.	*I look upon that in a different light.*
Il a vendu sa montre pour un morceau de pain.	*He sold his watch for a mere song.*
Vous lui avez donné la monnaie de sa pièce.	*You paid him in his own coin.*
Il a trouve a qui parler.	*He met with his match.*
Vous êtes un homme de parole.	*You are a man of your word.*
Je lui ai coupe la parole.	*I cut him short.*
Vous avez cela sur le cœur.	*You cannot digest that.*
Il se creuse la cervelle.	*He racks his brains.*
Le jeu n'en vaut pas la chandelle.	*The toll is more than the grist.*
Vous avez pris le change.	*You started upon the wrong scent.*
Chansons que tout cela.	*That is all nonsense.*
Les bons comptes font les bons amis.	*Short reckonings make long friends.*
Il met la charrue devant les bœufs.	*He puts the cart before the horse.*
Vous bâtissez des châteaux en Espagne.	*You build castles in the air.*
Je suis au comble de la joie.	*I am overjoyed.*
Ce n'est pas à vous de lui reprocher sa faute.	*It does not become you to reproach him with his fault.*
Il est tombe de Charybde en Scylla.	*He fell from the frying-pan into the fire.*
Cet homme cherche à vous en conter.	*That man is trying to deceive you.*
Nous sommes en pays de connaissance.	*We are here amongst acquaintances.*
La sentinelle nous coucha en joue.	*The sentinel levelled his gun at us.*
Ce malade n'en reviendra pas.	*That sick man will not recover.*
Nous sommes au courant de tout cela.	*We are perfectly acquainted with all that.*
Cela fait dresser les cheveux.	*That makes one's hair stand on end.*
Ils chantent sur une autre note.	*They have changed their tone.*
Ce vers est frappé au bon coin.	*That verse bears the right stamp.*
Je lui ai donné la clef des champs.	*I set him free.*
Il ne sait où donner de la tête.	*He does not know which way to turn.*
Vous vous donnez toujours raison.	*You pretend to be always in the right.*
Il a donné dans le piége.	*He fell into the snare.*
Cela lui donne de l'humeur.	*That puts him out of temper.*
Je n'entre point là dedans.	*That is no business of mine.*
Il entre dans vos intérêts.	*He interests himself for you.*
Je m'embarrasse fort peu de cela.	*I care very little about that.*
Son amitié est à toute épreuve.	*His friendship will stand any test.*
Vos propos m'échauffent les oreilles.	*Your expressions provoke my anger.*
Finissez ce badinage.	*Put an end to this trifling.*
Reposez-vous-en sur moi.	*Trust to me about this matter.*
Cette marchandise n'a point de débit.	*This article has no sale.*
Il est toujours sur le qui vive.	*He is always on the watch.*
Cette maison est à vendre au plus offrant et dernier enchérisseur.	*That house is to be sold to the highest bidder.*
De quelle part ce domestique vient-il ?	*Who sent that servant?*
Doublons le pas ; il se fait tard.	*Let us mend our pace; it is growing late.*
J'y vais de ce pas.	*I am going thither this moment.*
Passe pour ceci.	*Let this pass.*
Il faut en passer par là.	*We must submit to those terms.*
Vous m'avez peint avec de beaux traits !	*You have given a fine account of me!*
Pour moi, je m'y perds.	*As for me, I cannot see into it.*
Peu s'en fallut qu'il ne me frappât.	*He came very near striking me.*
Dites-moi un peu ce que vous en pensez.	*Just tell me what you think of it.*
Il nous jette de la poudre aux yeux.	*He throws dust into our eyes.*
Vous seriez bien embarrassé, si on vous prenait au mot.	*You would be at a great loss if you were taken at your word.*
Ne vous en prenez pas a moi.	*Do not blame me about this.*
Le malade n'en pouvait plus.	*The patient was quite exhausted.*
Je l'ai envoye promener.	*I sent him about his business.*
Le bon homme que c'est !	*What a simple man he is!*
Brisons là-dessus.	*No more of this.*
Il en fut quitte pour la peur.	*He got off for his fear.*
Vous en étes quitte à bon marché.	*You come off cheaply.*
Cela n'est pas de refus.	*That is not to be refused*
Je l'ai entrevu ce matin.	*I had a glimpse of him this morning.*
Je ne m'en soucie guère.	*I care but little about it.*
Il a des affaires par dessus la tête.	*He is over head and ears in business.*
Qu'à cela ne tienne.	*That shall not make us disagree.*
À la bonne heure.	*Well and good.*
Tout fin qu'il est, il s'est trompé.	*Cunning as he is, he made a mistake.*
Ce n'est pas là un trait d'ami.	*That is not acting like a friend.*
Trêve de compliments.	*No more compliments.*
Je vous vois venir, monsieur.	*I see what you are about, sir.*
Voilà comme vous êtes.	*That is the way with you.*
Tout cela va le mieux du monde.	*All goes on as well as possible.*
Vous n'y êtes pas.	*That is not it.*
Vous voilà bien avancé !	*You are much the better for it!*

French Words which are similar in Spelling or Pronunciation, but differ in Meaning.

In French, as in English, there are a large number of words which differ only to the practised ear in pronunciation, and sometimes are almost or precisely similar in spelling, but are totally different in meaning. The student will find the utmost difficulty at first in distinguishing them, especially when he hears them spoken. But the context and common sense will prove efficient guides, and a constant reference to the very full list given below will render the task of understanding French far easier. As we said before, when speaking of the idioms, we do not expect the student to learn the lists by heart, but he should keep them by him, and never hesitate to refer to them when in doubt. If, when he has read a portion of the list, he will cover up the English column, he will find it easy to test his knowledge.

French Words.	Meaning in English.
A.	
Accord, *nm.*	*accord, agreement, concord,* (mus.), *chord, strains.*
Accore, *nf.*	*prop.*
Accort, *adj.*	*good-humoured.*
Acre, *nm.*	*acre.*
Âcre, *adj.*	*acrid.*
Aine, *nf.*	*groin.*
Haine, *nf.*	*hatred.*
Air, *nm.*	*air.*
Aire, *nf.*	*threshing-floor, superfices; aerie, eyry.*
Haire, *nf.*	*sackcloth-shirt.*
Hère, *nm.*	*sorry fellow; poor wretch.*
Ère, *nf.*	*era.*
Alène, *nf.*	*awl.*
Haleine, *nf.*	*breath.*
Aller, *v.*	*to go.*
Haler, *v.*	*to haul, to heave; to set to (dogs).*
Hâler, *v.*	*to burn, to tan (of the sun).*
Allié, *nm.*	*ally.*
Hallier, *nm.*	*thicket.*
Amande, *nf.*	*almond, kernel.*
Amende, *nf.*	*fine, penalty.*
Ami, *nm.*	*friend.*
Amict, *nm.*	*amice, amict.*
Anche, *nf.*	*reed, mouth-piece of a hautboy; pipe of an organ.*
Hanche, *nf.*	*hip.*
Ancre, *nf.*	*anchor.*
Encre, *nf.*	*ink.*
Anoblir, *v.*	*to raise to the peerage.*
Ennoblir, *v.*	*to ennoble.*
Antre, *nm.*	*cave, den, cavern.*
Entre, *prep.*	*between.*
Août, *nm.* (a *silent*).	*August (month).*
Houe, *nf.*	agric.), *hoe.*
Houx, *nm.*	*holly-tree.*
Ou, *conj.*	*or.*
Où, *adv., pron.*	*where; in which.*
Appas, *nm.*	*charms, attractions; allurement.*
Appât, *nm.*	*bait.*
Après, *prep.*	*after.*
Apprêt, *nm.*	*preparation; dressing; cooking.*
Archer, *nm.*	*archer, bowman.*
Archet, *nm.*	*fiddlestick, bow.*
Are, *nm.*	*are*=119·6046 *sq. yds.*

French Words.	Meaning in English.
Arrhes, *nf. pl.*	*earnest-money.*
Art, *nm.*	*art.*
Hart, *nf.*	*withe; rope, halter.*
Aulx (*plur of.* **ail**), *nm.*	*garlic.*
Eau, *nf.*	*water.*
Haut, *adj.nm.*	*high; top.*
Os, *nm.*	*bone.*
Auspice, *nm.*	*auspice, omen, presage.*
Hospice, *nm.*	*alms-house, asylum.*
Autan, *nm.*	*south wind; auster.*
Autant, *adv.*	*as much; as many.*
Autel, *nm.*	*altar.*
Hotel, *nm.*	*hotel, inn; mansion.*
Auteur, *nm.*	*author, writer.*
Hauteur, *nf.*	*height; haughtiness.*
Avant, *prep.*	*before.*
Avent, *nm.*	*advent.*
Aveuglement, *nm.*	*blindness.*
Aveuglément, *adv.*	*blindly.*
B.	
Badine (*fem. of* **badin**), *adj.*	*waggish, roguish.*
Badine, *nf.*	*switch.*
Bai, -e, *adj.*	*bay (of horses).*
Baie, *nf.*	*bay; gulf; berry; trick.*
Bey, *nm.*	*bey.*
Bâilleur, *nm.*	*yawner, gaper.*
Bailleur, *nm.*	*lessor.*
Baiser, *v.*	*to kiss.*
Baisser, *v.*	*to stoop, to lower.*
Biaiser, *v.*	*to slope, to slant; to use shifts, evasions.*
Bal, *nm.*	*ball, dancing-party.*
Balle, *nf.*	*ball; bullet; husk of rice.*
Balai, *nm.*	*broom.*
Ballet, *nm.*	*ballet.*
Ban, *nm.*	*ban; public proclamation; banishment.*
Banc, *nm.*	*bench, form.*
Bas, *adj., nm.*	*low; stocking.*
Bat, *nm.*	*tail of a fish.*
Bât, *nm.*	*pack-saddle.*
Base, *nf.*	*basis, base.*
Basse, (*fem. of* **bas**), *adj.*	*low.*
Basse, *nf.*	(mus.), *bass, bass-string.*
Basse, *nf.*	*shallow.*
Bau, *nm.*	(nav.), *beam.*

French Words.	Meaning in English.
Baux (*pl. of* **bail**), *nm.*	*leases.*
Beau, *adj.*	*handsome, beautiful.*
Bot, *adj.*	*club-footed; club-foot.*
Bière, *nf.*	*beer.*
Biere, *nf.*	*coffin.*
Bis, *adj.*	*(of bread, etc.), brown.*
Bis, *adv.*	*encore.*
Bise (*fem. of* **bis**), *adj.*	*brown.*
Bise, *nf.*	*north wind.*
Bon, *adj., interj.*	*good;* (excl.), *well! good!*
Bon, *nm.*	*what is good; voucher, check.*
Bond, *nm.*	*bound, leap, jump.*
Bonne (*fem. of* **bon**), *adj.*	*good.*
Bonne, *nf.*	*maid-servant.*
Bouilli, *nm.*	*boiled beef.*
Bouillie, *nf.*	*pap.*
Bourdon, *nm.*	*pilgrim's staff;* (ent.) *drone.*
Bourdon, *nm.*	*great bell.*
Bourg, *nm.*	*country-town; market-town.*
Bourre, *nf.*	*(of wool) flock; wad; trash.*
Boue, *nf.*	*mud.*
Bout, *nm.*	*end, extremity.*
Brick, *nm.*	(nav.) *brig.*
Brique, *nf.*	*brick.*
Brocard, *nm.*	*taunt; joke; scoff.*
Brocart, *nm.*	*brocade.*
Broquart, *nm.*	(*hunt.*) *brocket.*
Brut, *nm.*	*rough; raw; unpolished;* (com.) *gross.*
Brute, *nf.*	*brute; beast; brutal person.*
C.	
Ça (*abb. of* **cela**), *pron.*	*that; that thing.*
Ça, *interj.*	*now, then.*
Sa, *adj.*	*her, his, its.*
Sas, *nm.*	*sieve, bolting-sieve; chamber (of weirs, locks).*
Cahot, *nm.*	*jerk; jolt.*
Chaos, *nm.*	*chaos; confusion.*
Cal, *nm.*	*callosity.*
Cale, *nf.*	(nav.) *hold (of ships); wedge; prop; block.*
Camp, *nm.*	*camp.*
Quand, *adv.*	*when.*
Quant à, *adv.*	*as to, as for.*
Campagne, *nf.*	*country-fields; country-seat.*

French Words.	Meaning in English.
Campagne, *nf.*	(milit.) *campaign;* (nav.) *cruise, voyage.*
Cane, *nf.*	*duck.*
Canne, *nf.*	*cane, stick.*
Canaux (*pl. of* **canal**), *nm.*	*canals.*
Canot, *nm.*	*ship's-boat; cutter; yawl.*
Cap, *nm.*	*headland, cape;* (nav.) *head.*
Cape, *nf.*	*cloak with a hood;* (nav.) *try-sail.*
Capital, *adj.*	*capital; chief; leading; main.*
Capital, *nm.*	*capital* (*money*); *stock.*
Capitale (*fem. of* **capital**), *adj.*	*capital; chief; leading; main.*
Capitale, *nf.*	*chief city.*
Capon, *nm.*	*sneak, mean fellow, hypocrite.*
Capon, *nm.*	(nav.) **cat-tackle.**
Car, *conj.*	*for, as.*
Carre, *nf.*	*breadth (of shoulders); crown (of a hat).*
Quart, *nm.*	*quarter; fourth; point (of the compass);* (nav.) *watch.*
Carriere, *nf.*	*race-ground; race; career; course.*
Carrière, *nf.*	*quarry (of stone, marble, etc.).*
Carte, *nf.*	*paste-board; card; ticket; bill of fare; account; map, chart.*
Quarte (*fem. of* **quart**), *adj.*	*fourth;* (med.) *quartan.*
Quarte, *nf.*	(mus.) *fourth;* (fenc.) *quarte;* (*piquet*) *quarte;* (ant.) *half a gallon.*
Cartier, *nm.*	*playing-card maker.*
Quartier, *nm.*	*quarter, fourth part; quarter (of a town, of the moon).*
Case, *nf.*	*division, pigeon-hole, compartment; hut; square (at chess, draughts); point (backgammon).*
Casse, *nf.*	(bot.) *cassia.*
Casse, *nf.*	*breakage;* (milit.) *cashiering.*
Casse, *nf.*	(print.) *case.*
Causer, *v.*	*to cause.*
Causer, *v.*	*to chat, to converse familiarly.*
Ce, *pron.*	*this, that, it.*
Se, *pron.*	*oneself.*
Céans, *adv.*	*here.*
Séant, *pp.*	*sitting.*
Séant, *nm.*	*sitting posture.*
Séant, *adj.*	*becoming, decent.*

French Words.	Meaning in English.	French Words.	Meaning in English.
Ceint, *pp.*	*girt.*	Chas, *nm.*	*eye* (*of needle*).
Cinq, *adj.*	*five.*	Chat, *nm.*	*cat.*
Sain, *adj.*	*healthy, sound.*	Schah, *nm.*	*shah.*
Saint, *adj.*	*sainted, saint.*		
Sein, *nm.*	*breast, bosom.*	Chasse, *nf.*	*chase ; hunt ; shooting.*
Seing, *nm.*	*signature.*		
		Châsse, *nf.*	*shrine, reliquary; frame ; handle (of lancets) ; check (of a balance).*
Celle, *pron.*	*this one, that one.*		
Sel, *nm.*	*salt*		
Selle, *nf.*	*saddle.*		
		Chaud, *adj. nm.*	*hot, warm ; heat, warmth.*
Cellier, *nm.*	*cellar.*		
Sellier, *nm.*	*saddler.*	Chaux, *nf.*	*lime.*
Cène, *nf.*	*Our Lord's Supper.*	Chenil, *nm.*	*kennel.*
		Chenille, *nf.*	*caterpillar.*
Scène, *nf.*	*scene ;* (theat.) *stage.*		
		Chœur, *nm.*	*chorus ; choir.*
Seine, *nf.*	*Seine*(*river*); *sein* (*fish-net*).	Cœur, *nm.*	*heart.*
Saine (*fem. of* sain), *adj.*	*healthy, sound.*	Coi, *adj.*	*quiet, still; snug.*
		Quoi, *pron.*	*what.*
Cens, *nm.*	*census.*	Chrême, *nm.*	*chrism, holy oil.*
Sens, *nm.*	*sense.*	Creme, *nf.*	*cream.*
Cense, *adj.*	*supposed.*	Chronique, *adj.*	(med.) *chronic.*
Sense, *adj.*	*sensible, wise.*		
Sensible, *adj.*	*sensitive.*	Chronique, *nf.*	*chronicle.*
Cent, *adj.*	*hundred.*	Ci (*abb. of* ici)	*here.*
Sang, *nm.*	*blood.*	Scie, *nf.*	*saw.*
Sans, *prep.*	*without.*	Si, *conj.*	*if, whether.*
		Six, *adj.*	*six.*
Cerf, *nm.*	*stag.*		
Serf, *nm.*	*serf.*	Cire, *nf.*	*wax.*
Serre, *nf.*	*hot-house, green-house, conservatory.*	Sire, *nm.*	*Sire.*
		Clause, *nf.*	*condition ; agreement.*
Cession, *nf.*	*transfer (of property).*		
		Close (*fem. of* clos), *adj.*	*closed ; shut.*
Session, *nf.*	*session ; sitting ; term (of law-courts).*		
		Coin, *nm.*	*corner.*
Chaîne, *nf.*	*chain.*	Coing, *nm.*	*quince.*
Chêne, *nm.*	*oak-tree.*		
		Coke, *nm.*	*coke.*
Chair, *nf.*	*flesh ; meat ; skin (of persons).*	Coq, *nm.*	*cock.*
		Coque, *nf.*	*shell (of eggs, nuts, snails) ; pearl-shell ;* (nav.) *hull ; cockle.*
Chaire, *nf.*	*pulpit; professorship ; desk (church).*		
Cher, *adj.*	*dear.*		
Chere (*fem. of* cher), *adj., nf.*	*dear; cheer; fare, living ; entertainment.*	Col, *nm.*	*neck ; collar.*
		Colle, *nf.*	*glue, paste, size.*
Champ, *nm.*	*field ; scope.*	Colon, *nm.*	(anat.) *colon.*
Chant, *nm.*	*singing ; chant.*	Colon, *nm.*	*colonist.*

FRENCH TRANSLATIONS.

Madame de Staël (1766–1817) was a daughter of Necker, popular minister of finance to Louis XVI. Brought up in one of the most brilliant circles in Paris, she early showed her genius, and in 1768 published a comedy, *Sophia*, and two tragedies, *Lady Jane Grey* and *Montmorenzy*.

In 1786 she was married to the Baron de Staël-Holstein, Swedish ambassador to the French Court. Although she upheld principles of liberty, she was strongly opposed to the violent policy of Robespierre, and, at the risk of her life, published a "Defence of the Queen." She objected to Napoleon's tyranny, and by him was driven into exile.

To her exile we owe the two best works she ever produced, "Corinne," a novel, and "L'Allemagne," a brilliant picture of German literature. After the battle of Waterloo Madame de Staël again appeared in Paris, and was favourably received by the King.

Besides the works already named, Madame de Staël wrote "Delphine," a novel, "Considerations on the French Revolution," "Ten Years of Exile," etc.

UNE SOCIÉTÉ DE PROVINCE.

La naissance, le mariage et la mort composaient toute l'histoire de notre société, et ces trois événements différaient là moins qu'ailleurs. Représentez-vous ce que c'était pour une Italienne comme moi, que d'être assise autour d'une table à thé plusieurs heures par jour après dîner avec la société de ma belle-mère. Elle était composée de sept femmes, les plus graves de la province; deux d'entre elles étaient les demoiselles de cinquante ans, timides comme à quinze, mais beaucoup moins gaies qu'à cet âge. Une femme disait à l'autre : "Ma chère, croyez-vous que l'eau soit assez bouillante pour la jeter sur le thé ?" "Ma chère," répondait l'autre, "je crois que ce serait trop tôt, car ces messieurs ne sont pas encore prêts à venir." "Resteront-ils longtemps à table aujourd'hui ?" disait la troisième : "qu'en croyez-vous, ma chère ?" "Je ne sais pas" répondait la quatrième ; "il me semble que l'élection du Parlement doit avoir lieu la semaine prochaine, et il se pourrait qu'ils restassent pour s'en entretenir." "Non," reprenait la cinquième, "je crois plutôt qu'ils parlent de cette chasse au renard qui les a tant occupés la semaine passée, et qui doit recommencer lundi prochain ; je crois cependant que le dîner sera bientôt fini." "Ah ! je ne l'espère guère," disait la sixième en soupirant, et le silence recommençait. J'avais été dans les couvents d'Italie ; ils me paraissaient pleins de vie à côte de ce cercle, et je ne savais qu'y devenir.

Tous les quarts d'heure il s'élevait une voix qui faisait la question la plus insipide pour obtenir la réponse la plus froide ; et l'ennui soulevé retombait avec un nouveau poids sur ces femmes, que l'on aurait pu croire malheureuses, si l'habitude prise dès l'enfance n'apprenait pas à tout supporter. Enfin les messieurs revenaient, et ce moment si attendu n'apportait pas un grand changement dans la manière d'être des femmes : les hommes continuaient leur conversation auprès de la cheminée ; les femmes restaient dans le fond de la chambre, distribuaient les tasses de thé ; et quand l'heure du départ arrivait, elles s'en allaient avec leurs époux, prêtes à recommencer le lendemain une vie qui ne différait de celle de la veille que par la date de l'almanach et par la trace des années, qui venait enfin s'imprimer sur le visage de ces femmes comme si elles eussent vécu pendant ce temps.

APPLIED MECHANICS.—III.

[*Continued from p.* 35.]

WORK OR ENERGY—LAW OF WORK—PERPETUAL MOTION—EFFICIENCY OF A MACHINE—NUMERICAL CALCULATIONS OF WORK, ETC.

WE have seen something of the connection which exists between the friction of a machine and the load on the machine, and we have found that friction increases as the load increases, that friction always acts *against* motion helping the weaker force, and that the greater useful effect we produce by means of a machine, the greater *wasteful* effect does friction also produce. Before, however, we can deduce any *law* as to the way in which the "efficiency" of a machine varies, it will be necessary to study the action of the machine from the point of view of *work* or *energy*.

WORK, ENERGY, ETC.

A force is said to do work when it is exerted through a certain distance in its own direction. If the force is measured in pounds—the force of one pound being taken to mean the pull of the earth on that mass which we call one pound weight when the mass is situated at the sea-level at Greenwich—and the distance through which the force acts is measured in feet, the product of the two will give the work done by the force in foot-pounds. In other words, the British engineer's unit of work is the amount of work necessary to raise one pound weight one foot high in London.

It is usual to speak of work being done when an opposing force or resistance is overcome, but work may also be done in altering a body's rate of motion, the resistance in that case being of a different kind, and due to what is sometimes called the body's *inertia*.

Energy is the capability of doing work. Any agent which can do work is said to be possessed of energy. It is well, in studying Mechanics, to base our reasoning, as far as possible, on the elementary conception of *work*, as almost all students have, or can soon grasp, this idea, and upon it can be built most of the laws of mechanics.

Nature supplies us with almost unlimited stores of energy. The moving air or wind, the great stores of coal, the water in our rivers and streams, and even the tides may all be utilised, and form stores of energy "for the use and convenience of man." It is true that in utilising these stores of energy there is always considerable waste, and in no case is this truer than in utilising our stores of coal. When we think that 1 lb. of coal gives out energy equivalent to about 11,000,000 foot-pounds of work in burning, and that if 2 lb. of this coal are burnt in the furnace of a very good steam-engine for one hour, the engine will not give out more than 33,000 × 60 = 1,980,000 foot-pounds of work—about $\frac{1}{11}$th of the energy in the coal—we begin to have some doubts as to whether our legacy of energy in this shape may not in time be squandered.

It must not be thought that the difference of the amounts of energy supplied to and given out by the engine is *destroyed*, or disappears altogether. It merely takes another form in which it is less useful to us, hence we speak of it as being *wasted*. Energy can *neither be created nor destroyed* by any process with which man is acquainted, but it does tend to take what is called a lower or less useful form. A body at a certain height possesses a store of energy in the form of *potential energy*; it is one of the higher forms of energy, and is readily converted into useful effect. For instance, it would be easy to tie a rope to a stone on a hill-side, pass the rope over a pulley, and let it turn a machine by its descent. Also the form of energy possessed by a moving body, which we call *kinetic energy*, may be converted into useful effect without any great waste, as when the fly-wheel of a steam-engine continues the motion of the engine after the steam is shut off. A body which can give out heat also possesses energy, but it is in a lower or less useful form. Thus the pound of coal possesses an immense store of energy, but we have to burn it in the furnace of an engine, and make use of a great deal of complicated mechanism in order to get even a small fraction of it converted into the useful form of mechanical work.

There is always this tendency for energy to run down into the lower or less useful form of heat. When the parts of a machine rub together, friction occurs and heat is produced, part of the energy supplied to the machine making its appearance in this form. But the total amount of energy can neither be *increased* nor *diminished*; this is known as the principle of the Conservation of Energy.

The sciences of electricity and magnetism reveal to us the existence of other forms of *molecular* energy, but the law is still true, that for every foot-pound of energy which makes its appearance in one form, one foot-pound in some other form must have disappeared. It is easy to see from this how futile are the efforts which have been made to construct a "perpetual motion." It is impossible to construct a machine which will offer absolutely *no* resistance to motion, and wherever such resistance is met with, energy is spent in overcoming it;

hence the energy given out by the machine must be *less* than that supplied to it. Suppose we start with a certain stock of energy, and merely make it go round and round the cycle of the machine—as, for instance, when water is supplied to a water-wheel attached to a pump which pumps the water up again to turn the wheel—it must in time be wasted, or take a lower form, in overcoming frictional and other resistances. Hence, the law of the conservation of energy directly affirms the *impossibility of a perpetual motion.* This amounts to a law, which has been called the LAW OF WORK, and which may be stated as follows:—If we give twenty foot-pounds of energy to a machine, and there is *no friction, no waste,* and *no storage* of energy, twenty foot-pounds in the same or some other shape must be got from it. It will easily be seen that the last limitation is as necessary as the others, for one can readily imagine a machine in which by, say, the straining of a spring or in some way, energy is stored; the strain energy of the spring being a kind of potential energy. Another form of potential energy is that possessed by chemical elements, which combine readily when they are placed in a position in which such combination can take place, as, for instance, gunpowder. When a gun is discharged, this large store of energy is spent, partly in giving kinetic energy to the bullet, and partly in heating the gun and surrounding air, in producing vibrations, etc., and altogether none of it is lost, though the transformation from one form of energy to another is very rapid. Someone may ask, from what cause do we more immediately derive these great stores of energy to be found in nature? Well, we can trace the majority of them to the sun. The sun has shone for ages, preparing plants for being converted into coal, raising water by evaporation to be discharged into reservoirs and rivers, and, in fact, providing us with mighty stores of energy for the accomplishment of works of "human art." How to use these stores *economically* is the great engineering problem of the day. This is immediately connected with our next subject—

THE EFFICIENCY OF MACHINES.

We have already used the term "machine," and shall have occasion often to use it in the course of these lessons. Most people know what is meant by the term, but it may be well to give a definition of it. Combining the definitions of two of our greatest authorities, we have the following:—"A machine is a collection of parts designed for the modification of force or motion, or for the transformation or transmission of energy." The definition, however, might be restricted so as to read, "a machine is a collection of parts for the transformation of energy, or for its application to a particular purpose."

What do we mean by the efficiency of a machine? Everyone understands that a machine which has a large amount of friction in its various parts, either from defective construction or otherwise, will only give out a small portion of the energy supplied to it. It will then, in ordinary language, be *inefficient.* By the efficiency of a machine is meant the percentage of the energy supplied to it which is obtained from it when working at a steady speed. This may be put in the shape of a formula, thus—

$$\text{Efficiency} = \frac{\text{work given out}}{\text{work put in}}.$$

This efficiency is not constant for any one machine, but varies with the load on the machine, being usually higher for greater loads, but becoming more nearly constant as the maximum load of the machine is approached. A few examples of the method of calculating work will be useful here.

NUMERICAL CALCULATIONS OF WORK, ETC.

1. How many units of work are expended in raising one hundredweight from a depth of 60 fathoms?

The work done in raising a weight is measured by weight in pounds multiplied by the height in feet through which it is raised; hence, in this case, since one fathom = 6 feet, the work expended is $112 \times 60 \times 6 = 40{,}320$ foot-pounds.

2. How many units of work are spent in filling a tank with water; the tank is 12 feet long, 6 feet wide, and $2\frac{1}{2}$ feet deep inside, and the water has to be lifted an average distance of 20 feet?

The content of the cistern is $12 \times 6 \times 2\frac{1}{2} = 180$ cubic feet, and one cubic foot of water weighs about 62·4 lb.; hence the entire weight to be lifted is $180 \times 62{\cdot}4$ lb., and the work to be done is $180 \times 62{\cdot}4 \times 20 = 224{,}640$ foot-pounds.

3. How many units of work are required to raise the materials for building a solid column of brickwork 100 feet high, the section of which is uniform, and 14 feet square; one cubic foot of brickwork weighing 112 lb.?

The student should carefully distinguish between the expressions "14 feet square" and "14 square feet." The former means a square of 14 feet side; and hence of area $= 14 \times 14$ or 196 square feet.

The whole content of the column is $100 \times 196 = 19{,}600$ cubic feet, and the weight of material in it is $19{,}600 \times 112$ lb.

But this material has not to be all lifted the same height; the work done in a case of this kind is found by multiplying the total weight lifted by the height of the centre of gravity* of the mass when in its raised position. In this case, since the section is everywhere the same, the centre of gravity is at half the height of the column. The work to be done is, then, 19,600 × 112 × 50 = 109,760,000 foot-pounds.

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* The meaning of the term "centre of gravity" will be explained in a later lesson.

4. The mean section of a stream is 8 feet × 2 feet; its mean velocity 2 miles an hour, and there is at a certain point on the stream a fall of 12 feet. Find the number of foot-pounds of energy running to waste every minute at this fall.

The quantity in cubic feet passing every minute is found by multiplying the mean section of the stream in square feet by the mean velocity of the water in feet per minute. The latter is found thus—

$$\begin{aligned}\text{2 miles an hour} &= 2 \times 5280 \text{ feet per hour.}\\ &= \frac{2 \times 5280}{60} \text{ or 176 feet per minute.}\end{aligned}$$

The quantity per minute is then 16 × 176 cubic feet, and its weight is 16 × 176 × 62·4 lb. This multiplied by the height of the fall, 12 feet, gives the answer, 2,108,620 foot-pounds.

5. Given that a man walking and pushing or pulling can do 3,130 foot-pounds of work in one minute, how many men would be required to raise, by means of a capstan the friction of which is neglected, an anchor weighing 2 tons from a depth of 28 fathoms in 15 minutes? Answer, 16 men.

6. Find the work done per minute by steam, whose mean pressure is 40 lb. per square inch, on the piston of a steam-engine, the mean piston area exposed to steam pressure being 113 square inches, the stroke of the piston 2 feet, and there being 192 working strokes per minute.

Answer, 1,735,680 foot-pounds.

ALGEBRA.—XIV.

[*Continued from p.* 30.]

ADFECTED QUADRATIC EQUATIONS (*continued*).

257. We now furnish a set of problems in Adfected Quadratic Equations for practice.

EXERCISE 66.

1. To find two numbers whose difference shall be 12, and the sum of their squares 360.

2. Two persons draw prizes in a lottery, the difference of which is £120, and the greater is to the less as the less to 10. What are the prizes?

3. What two numbers are those whose sum is 6, and the sum of their cubes 72?

4. Divide the number 56 into two such parts that their product shall be 640.

5. A gentleman bought a number of pieces of cloth for 675 crowns, which he sold again at 48 crowns per piece, and gained by the bargain as much as one piece cost him. What was the number of pieces?

6. A and B started together for a place 150 miles distant. A's hourly progress was 3 miles more than B's, and he arrived at his journey's end 8 hours and 20 minutes before B. What was the hourly progress of each?

7. The difference of two numbers is 6; and if 47 be added to twice the square of the less, it will be equal to the square of the greater. What are the numbers?

8. A and B distributed £1,140 each among a certain number of persons. A relieved 40 persons more than B, and B gave to each individual £5 more than A. How many were relieved by A and B?

9. Find two numbers whose sum is 10, and the sum of their squares 58.

10. Several gentlemen made a purchase together for £175. Two of them having withdrawn, the bill was paid by the others, each furnishing £10 more than would have been his equal share if the bill had been paid by the whole company. What was the number in the company at first?

11. A merchant bought several yards of cloth for £60, out of which he reserved 15 yards, and sold the remainder for £54, gaining two shillings a yard. How many yards did he buy, and at what price?

12. A person bought two cubical stacks of hay for £15, each of which cost as many shillings per solid yard as there were yards in a side of the other, and the greater stood on more ground than the less by 7 square yards. Find the price of each stack.

13. A gentleman bought two pieces of cloth, the finer of which cost four shillings a yard more than the other. The finer piece cost £18; but the coarser one, which was two yards longer than the finer, cost only £16. How many yards were there in each piece; and what was the price of a yard of each?

14. A merchant bought 54 gallons of Madeira wine, and a certain quantity of Teneriffe. For the former he gave half as many shillings by the gallon as there were gallons of Teneriffe, and for the latter four shillings less by the gallon. He sold the mixture at ten shillings by the gallon, and lost £28 16s. by his bargain. Required the price of the Madeira, and the number of gallons of Teneriffe.

15. A person being asked his age replied, "If you add the square root of it to half of it, and subtract 12, the remainder will be nothing." What was his age?

16. Two casks of wine were purchased for 58 crowns, one of which contained 5 gallons more than the other, and the price by the gallon was 2 crowns less than one-third of the number of gallons in the smaller cask. Required the number of gallons in each, and the price by the gallon.

17. If the square of a certain number be taken from 40, and the square root of this difference be increased by 10, and the sum be multiplied by 2, and the product divided by the number itself, the quotient will be 4. What is the number?

18. A person bought a certain number of oxen for 80 guineas. If he had received 4 more oxen for the same money, he would have paid one guinea less for each. Find the number of oxen.

19. It is required to divide 24 into two such parts that their product shall be equal to 35 times their difference.

20. The sum of two numbers is 60, and their product is to the sum of their squares as 2 to 5. What are the numbers?

21. Divide 146 into two such parts, that the difference of their square roots may be 6.

22. What two numbers are those whose difference is 16 and their product 36?

23. Find two fractions whose sum shall be $\frac{5}{6}$, and the sum of their reciprocals 6 times as much.

24. Required to find two numbers whose difference is 15, and half of their product is equal to $\frac{3}{8}$ of the cube of the less number.

25. A company incurred a bill of £8 8s. One of them absconded before it was paid, and in consequence those who remained had to pay four shillings apiece more than their just share. How many were there in the company?

26. A gentleman bequeathed £7 4s. to his grandchildren; but before the money was distributed two more were added to their number, and consequently the former received one shilling

apiece less than they otherwise would have done. How many grandchildren did he leave?

27. The length added to the breadth of a rectangular room makes 42 feet, and the room contains 432 square feet. Required the length and breadth.

28. A says to B, "The product of our years is 120; and if I were 3 years younger, and you were 2 years older, the product of our ages would still be 120." How old was each?

29. Should the square of a certain number be taken from 89, and the square root of their difference be increased by 12, and the sum multiplied by 4, and the product divided by the number itself, the quotient will be 8½. What is the number?

30. A mason laid 105 rods of wall, and on reflection found that if he had laid 2 rods less per day, he would have been 6 days longer in accomplishing the job. How many rods did he build per day?

31. The length of a gentleman's garden exceeded its breadth by 5 rods. It cost him 3 crowns per rod to fence it; and the whole number of crowns which the fence cost was equal to the number of square rods in the garden. What were its length and breadth?

32. What number is that which being added to its square root will make 156?

33. The circumference of a grass plot is 48 yards, and its area is equal to 35 times the difference of its length and breadth. What are its length and breadth?

34. A gentleman purchased a building plot, and in the centre of it erected a house 54 feet long and 36 feet wide, which covered just one-half his land. This arrangement left him a flower-border of uniform width all round his house. What was the width of his border, what the length and breadth of his plot, and how much land did he buy?

35. A general wished to arrange his army, which consisted of 20,886 men, in a solid body, so that each rank should exceed each file by 59 men. How many must he place in rank and file?

36. A man has a painting 18 inches long, and 12 inches wide, which he orders the cabinet-maker to put into a frame of uniform width, and to have the area of the frame equal to that of the painting. Of what width will the frame be?

37. A man having to walk 54 miles, finds that if he increases his speed half a mile per hour, he will perform his task 1½ hours sooner than if he walked at his usual rate. Find that rate.

38. A merchant sold a quantity of goods for £39, and gained as much per cent. as the goods cost him. How much did he pay for the goods?

39. Suppose in a garden, 400 feet long and 300 feet broad, there is a walk 10 feet wide all round the garden, equidistant from and parallel to the wall, and that it divides the garden into two equal parts; that is, the area betwixt the wall and walk is the same as the area within the walk. Required the breadth of the space between the wall and the walk.

40. A and B started from two cities 247 miles apart, and travelled the same road till they met. A's progress was 1 mile per day less than B's, and the number of days before they met was greater by 3 than the number of miles B went per day. How many miles did each travel?

41. Two persons, A and B, invest £2,000 in business. A's money remained in trade 17 months, and he received £1,710 for his share of the profit and stock; B's money was in trade 12 months, and he received £1,040 for his share of the profit and stock. What was each partner's stock?

42. A merchant bought a piece of cloth for 162 florins; the number of shillings which he paid per yard was $\frac{4}{9}$ of the number of yards. Required the length of the cloth, and the price per yard.

43. There was a cask containing 20 gallons of wine; a quantity of this was drawn off and put into another cask of equal size, and then this last was filled with water; and afterwards the first cask was filled with the mixture from the second. It appears that if 6⅔ gallons are now drawn from the first and put into the second, there will be equal quantities of wine in each cask. How much wine was first drawn off?

44. A man bought 80 lb. of pepper and 100 lb. of ginger for £65, at such prices that he obtained 60 lb. more of ginger for £20 than he did of pepper for £10. What did he pay per pound for each?

RATIO AND PROPORTION.

258. The design of mathematical investigations is to arrive at the knowledge of particular quantities, by comparing them with other quantities, either *equal* to, or *greater*, or *less* than those which are the objects of inquiry. This end is most commonly attained by means of a series of *equations* and *proportions*. When we make use of equations, we determine the quantity sought, by discovering its *equality* with some other quantity or quantities already known.

We have frequent occasion, however, to compare the unknown quantity with others which are *not equal* to it, but either greater or less.

Unequal quantities may be compared with each other in two ways:—

(1) We may inquire *how much* one of the quantities is greater than the other; or,

(2) We may inquire *how many times* one quantity contains the other.

The *relation* which is found to exist between the two quantities compared is called the *ratio* of the two quantities.

RATIO *is of two kinds, arithmetical and geometrical.* It is also sometimes called *ratio by subtraction* and *ratio by division.*

259. ARITHMETICAL RATIO *is the* DIFFERENCE *between two quantities or sets of quantities.* The quantities themselves are called the *terms* of the ratio, that is, the terms between which the ratio exists. Thus 2 is the arithmetical ratio of 5 to 3. This is sometimes expressed by placing two points between the quantities, thus, $5\cdot\cdot3$, which is the same as $5-3$. Indeed, the term *arithmetical ratio*, and its notation by points, are almost needless, and are seldom used. For the one is only a substitute for the word *difference*, and the other for the sign $-$.

If both the terms of an arithmetical ratio be *multiplied* or *divided* by the same quantity, the *ratio* will, in effect, be multiplied or divided by that quantity.

Thus, if $a - b = r$,

Then multiplying both sides by h (Ax. 3), $ha - hb = hr$,

And dividing by h (Ax. 4), $\frac{a}{h} - \frac{b}{h} = \frac{r}{h}$.

If the terms of one arithmetical ratio be added to, or subtracted from, the corresponding terms of another, the ratio of their sum or difference will be equal to the sum or difference of the two ratios.

$$\left.\begin{array}{l}\text{If } a - b\\ \text{And } d - h\end{array}\right\}\text{ are the two ratios,}$$

Then $(a + d) - (b + h) = (a - b) + (d - h)$; for each $= a + d - b - h$.

And $(a - d) - (b - h) = (a - b) - (d - h)$; for each $= a - d - b + h$.

Thus the arithmetical ratio of 11 ·· 4 is 7,
And the arithmetical ratio of 5 ·· 2 is 3.

The ratio of the *sum* of the terms 16 ·· 6 is 10, which is also the sum of the ratios 7 and 3.

The ratio of the *difference* of the terms 6 ·· 2 is 4, which is also the difference of the ratios 7 and 3.

260. GEOMETRICAL RATIO *is that relation between quantities which is expressed by the* QUOTIENT *of the one divided by the other.*

Thus the ratio of 8 to 4 is $\frac{8}{4}$ or 2; for this is the quotient of 8 divided by 4. In other words, it shows how often 4 is contained in 8.

The two quantities compared are called a *couplet.* The *first* term is the *antecedent*, and the *last* the *consequent.*

Geometrical ratio is expressed in *two ways.*

(1) In the form of a *fraction*, making the *antecedent* the *numerator*, and the *consequent* the *denominator;* thus the ratio of a to b is $\frac{a}{b}$. And

(2) By placing a *colon* between the quantities compared; thus, $a : b$ expresses the ratio of a to b.

Of these three, the antecedent, the consequent, and the ratio, any *two* being given, the other may be found.

Let $a =$ the antecedent, $c =$ the consequent, $r =$ the ratio.

By definition $r = \frac{a}{c}$; that is, the ratio is equal to the antecedent divided by the consequent.

Multiplying by c, $a = cr$; that is, the antecedent is equal to the consequent multiplied into the ratio.

Dividing by r, $c = \frac{a}{r}$; that is, the consequent is equal to the antecedent divided by the ratio.

If two couplets have their antecedents equal, and their consequents equal, their ratios must be equal.

If in two couplets the ratios are equal, and the antecedents equal, the consequents are equal; and if the ratios are equal and the consequents equal, the antecedents are equal.

If the two quantities compared are *equal*, the ratio is a unit, *or a ratio of equality.* The ratio of $3 \times 6 : 18$ is a unit, for the quotient of any quantity divided by itself is 1.

If the antecedent of a couplet is *greater* than the consequent, the ratio is greater than a unit. For if a dividend is greater than its divisor, the quotient is greater than a unit. Thus the ratio of 18 : 6 is 3. This is called a ratio of *greater inequality.*

On the other hand, if the antecedent is *less* than the consequent, the ratio is less than a unit, and is called a ratio of *less inequality.* Thus, the ratio of 2 : 3 is less than a unit, because the dividend is less than the divisor.

261. INVERSE *or* RECIPROCAL RATIO *is the ratio of the reciprocals of two quantities.*

Thus, the reciprocal ratio of 6 to 3 is $\frac{1}{6}$ to $\frac{1}{3}$; that is, $\frac{1}{6} \div \frac{1}{3}$.

The direct ratio of a to b is $\frac{a}{b}$; that is, the antecedent divided by the consequent.

The reciprocal ratio is $\frac{1}{a} : \frac{1}{b}$; or, $\frac{1}{a} \div \frac{1}{b} = \frac{1}{a} \times \frac{b}{1} = \frac{b}{a}$; that is, the consequent b divided by the antecedent a.

Hence a reciprocal ratio is expressed by *inverting the fraction* which expresses the direct ratio; or when the notation is by points, by *inverting the order of the terms.*

Thus, a is to b inversely as b to a.

262. COMPOUND RATIO *is the ratio of the* PRODUCTS *of the corresponding terms of two or more simple ratios.*

$$\begin{array}{ll}\text{Thus the ratio of} & 6 : 3,\text{ is } 2,\\ \text{And the ratio of} & 12 : 4,\text{ is } 3,\\ \hline \text{The ratio compounded of these is} & 72 : 12 = 6.\end{array}$$

Here the compound ratio is obtained by multiplying together the two antecedents, and also the two consequents of the simple ratios. Hence it is equal to the product of the simple ratios.

Compound ratio is not different in its *nature* from any other ratio. The term is used to denote the origin of the ratio in particular cases.

If in a series of ratios the consequent of each preceding couplet is the antecedent of the following one, *the ratio of the first antecedent to the last consequent is equal to that which is compounded of all the intervening ratios.*

Thus, in the series of ratios, $a : b$,
$b : c$,
$c : d$,
$d : h$,

the ratio of $a : h$ is equal to that which is compounded of the ratios of $a : b$, of $b : c$, of $c : d$, and of $d : h$. For the compound ratio by the last article is $\frac{ab\,cd}{bc\,dh} = \frac{a}{h}$, or $a : h$.

A particular class of compound ratios is produced by multiplying a simple ratio in *itself*, or into another *equal* ratio. These are termed *duplicate*, *triplicate*, *quadruplicate*, etc., according to the number of multiplications.

A ratio compounded of *two* equal ratios, that is, the *square* of the simple ratio, is called a *duplicate* ratio.

One compounded of *three*, that is, the *cube* of the simple ratio, is called a *triplicate* ratio, etc.

In a similar manner the ratio of the *square roots* of two quantities is called a *subduplicate* ratio; that of the *cube roots* a *subtriplicate* ratio, etc.

Thus, the simple ratio of a to b is $a : b$.
The duplicate ratio of a to b is $a^2 : b^2$.
The triplicate ratio of a to b is $a^3 : b^3$.
The subduplicate ratio of a to b is $\sqrt{a} : \sqrt{b}$.
The subtriplicate ratio of a to b is $\sqrt[3]{a} : \sqrt[3]{b}$, etc.

N.B.—The terms *duplicate*, *triplicate*, etc., must not be confounded with *double*, *triple*, etc.

The ratio of 6 to 2 is	$6 : 2 = 3$.
Double this ratio, that is, *twice* the ratio, is	$12 : 2 = 6$.
Triple the ratio, *i.e.*, *three times* the ratio, is	$18 : 2 = 9$.
The *duplicate* ratio, *i.e.*, the *square* of the ratio, is	$6^2 : 2^2 = 9$.
The *triplicate* ratio, *i.e.*, the *cube* of the ratio, is	$6^3 : 2^3 = 27$.

263. That quantities may have a ratio to each other, it is necessary that they should be so far of the same nature, that one can properly be said to be either equal to, or greater, or less than the other. Thus a foot has a ratio to an inch, for one is twelve times as great as the other.

264. From the mode of expressing *geometrical ratios* in the *form* of a *fraction*, it is obvious that the *ratio* of two quantities is the same as the *value* of a fraction whose numerator and denominator are equal to the antecedent and consequent of the given ratio. Hence,

To multiply or divide both the antecedent and consequent by the same quantity, does not alter the ratio. To multiply or divide the antecedent alone by any quantity, multiplies or divides the ratio; to multiply the consequent alone, divides the ratio; and to divide the consequent, multiplies the ratio. That is, *multiplying* and *dividing* the antecedent or consequent has the *same* effect on the *ratio*, as a similar operation, performed on the numerator or denominator, has upon the *value* of a fraction.

If to or from the terms of any couplet, two other quantities having the same ratio be added or subtracted, the sums or remainders will also have the same ratio. Thus the ratio of 12 : 3 is the same as that of 20 : 5. And the *ratio* of the *sum* of the *antecedents* 12 + 20, to the *sum* of the *consequents* 3 + 5, is the same as the ratio of either couplet. That is,

$$12 + 20 : 3 + 5 :: 12 : 3 = 20 : 5,$$

$$\text{or } \frac{12 + 20}{3 + 5} = \frac{12}{3} = \frac{20}{5} = 4.$$

So also the *ratio* of the *difference* of the *antecedents* to the *difference* of the *consequents* is the same. That is,

$$20 - 12 : 5 - 3 :: 12 : 3 = 20 : 5,$$

$$\text{or } \frac{20 - 12}{5 - 3} = \frac{12}{3} = \frac{20}{5} = 4.$$

If in several couplets the ratios are equal, *the sum of all the antecedents has the same ratio to the sum of all the consequents, which any one of the antecedents has to its consequent.*

$$\text{Thus the ratio} \begin{cases} 12 : 6 = 2. \\ 10 : 5 = 2. \\ 8 : 4 = 2. \\ 6 : 3 = 2. \end{cases}$$

Therefore the ratio of

$$(12 + 10 + 8 + 6) : (6 + 5 + 4 + 3) = 2.$$

Exercise 67.

1. Which is the greater, the ratio of 11 : 9, or that of 44 : 35?
2. Which is the greater, the ratio of $a + 3 : \frac{1}{3}a$, or that of $2a + 7 : \frac{1}{4}a$?
3. If the antecedent of a couplet be 65, and the ratio 13, what is the consequent?
4. If the consequent of a couplet be 7, and the ratio 13, what is the antecedent?
5. What is the ratio compounded of the ratios of 3 : 7, and $2a : 5b$, and $7x + 1 : 3y - 2$?
6. What is the ratio compounded of $x + y : b$, and $x - y : a + b$, and $a + b : h$?
7. If the ratios of $5x + 7 : 2x - 3$, and $x + 2 : \frac{1}{2}x + 3$ be compounded, will they produce a ratio of greater inequality, or of less inequality?
8. What is the ratio compounded of $x + y : a$, and $x - y : b$, and $b : \frac{x^2 - y^2}{a}$?
9. What is the ratio compounded of 7 : 5, and the duplicate ratio of 4 : 9, and the triplicate ratio of 3 : 2?
10. What is the ratio compounded of 3 : 7, and the triplicate ratio of $x : y$, and the subduplicate ratio of 49 : 9?

PROPORTION.

265. When four quantities are related to one another in such a manner that the first divided by the second is equal to the third divided by the fourth—in other words, when the ratio of the first to the second is equal to the ratio of the third to the fourth, the four are said to be in direct proportion. From this definition it will be seen that proportion is simply the equality of ratios. Though we have only spoken of two equal ratios, there may be any number, and in all cases the terms of these ratios are said to be in direct proportion.

Care must be taken not to confound *proportion* with *ratio*. This caution is the more necessary, as in common discourse the two terms are used indiscriminately, or rather, proportion is used for both. The expenses of one man are said to bear a greater proportion to his income than those of another. But according to the definition which has just been given, one *proportion* is neither greater nor less than another. For *equality* does not admit of degrees. One *ratio* may be greater or less than another. The ratio of 12 : 2 is greater than that of 6 : 2, and less than that of 20 : 2. But these differences are not applicable to *proportion*, when the term is used in its technical sense. The loose signification which is so frequently attached to this word, may be proper enough in *familiar language;* for it is sanctioned by general usage. But for scientific purposes, the *distinction* between *proportion* and *ratio* should be clearly drawn and cautiously observed.

Proportion may be expressed either by the common sign of equality, or by four points between the two couplets.

Thus

$$\left.\begin{array}{l} 8 \cdot\cdot 6 = 4 \cdot\cdot 2, \text{ or } 8 \cdot\cdot 6 :: 4 \cdot\cdot 2 \\ a \cdot\cdot b = c \cdot\cdot d, \text{ or } a \cdot\cdot b :: c \cdot\cdot d \end{array}\right\} \text{are arithmetical proportions.}$$

And

$$\left.\begin{array}{l} 12 : 6 = 8 : 4, \text{ or } 12 : 6 :: 8 : 4 \\ a : b = d : h, \text{ or } a : b :: d : h \end{array}\right\} \text{are geometrical proportions.}$$

The latter is read, "the ratio of a to b equals the ratio of d to h;" or more concisely, "a is to b as d to h."

The first and last terms are called the *extremes*, and the other two the *means*. *Homologous* terms are either the two antecedents or the two consequents. *Analogous* terms are the antecedent and consequent of the same couplet.

As the ratios are equal, it is manifestly immaterial which of the two couplets is placed first.

If $a : b :: c : d$, then $c : d :: a : b$.

For if $\frac{a}{b} = \frac{c}{d}$, then $\frac{c}{d} = \frac{a}{b}$.

The *number* of *terms* in a proportion must be at least *four*. For the equality is between the ratios of *two couplets;* and each couplet must have an antecedent and a consequent. There may be a proportion, however, between *three quantities;* for one of the quantities may be *repeated*, so as to form two terms. In this case the quantity repeated is called the *middle term*, or a *mean proportional* between the two other quantities, especially if the proportion is geometrical.

Thus the numbers 8, 4, 2, are proportional. That is, 8 : 4 : : 4 : 2. Here 4 is both the consequent in the first couplet, and the antecedent in the last. It is therefore a mean proportional between 8 and 2.

The *last* term is called a *third proportional* to the two other quantities. Thus 2 is a third proportional to 8 and 4.

Inverse or *reciprocal* proportion is an equality between a *direct* ratio and a *reciprocal* ratio.

Thus $4 : 2 :: \frac{1}{3} : \frac{1}{6}$; that is, 4 is to 2 *reciprocally*, as 3 to 6. Sometimes, also, the order of the terms in one of the couplets is inverted, without writing them in the form of a fraction.

Thus 4 : 2 : : 3 : 6 inversely. In this case, the *first* term is to the *second*, as the *fourth* to the *third;* that is, the first divided by the second is equal to the fourth divided by the third.

When there is a series of quantities, such that the ratios of the first to the second, of the second to the third, of the third to the fourth, etc., are *all equal*, the quantities are said to be in *continued proportion*. The consequent of each preceding ratio is then the antecedent of the following one.

N.B.—Continued proportion is also called *progression*.

In the preceding articles of this section, the general properties of ratio and proportion have been defined and illustrated. It now remains to consider the principles which are peculiar to each kind of proportion, and attend to their practical application in the solution of problems.

KEY TO EXERCISES.

EXERCISE 62.

1. $4b \pm \sqrt{16b^2 + h}$.
2. $\pm \sqrt{\left(\frac{a^2}{4} + b + h\right)} - \frac{a}{2}$
3. $\frac{1}{2} \pm \sqrt{\frac{1}{4} + h - d}$.
4. $\pm \sqrt{d + 8\frac{1}{4}} - \frac{3}{2}$
5. $\frac{ab}{2} \pm \sqrt{\frac{a^2b^2}{4} + ac - cd}$.
6. $\pm \sqrt{\frac{a^2}{4b^2} + h} - \frac{a}{2b}$.
7. $\frac{1}{2b} \pm \sqrt{\frac{1}{4b^2} + 7h}$.
8. $\frac{\pm \sqrt{(a-1)^2 + 4b} - (a-1)}{2}$.

EXERCISE 63.

1. 4 or − 14.
2. $\pm \sqrt{\frac{a}{b}(d-h) + \frac{a^2}{b^2}} - \frac{a}{b}$.
8. $\frac{1 \pm \sqrt{1 + (a+1)h}}{a+1}$.

EXERCISE 64.

1. $\frac{\pm \sqrt{d^2 + 4ah} - d}{2a}$.
2. 3 or $-4\frac{2}{3}$.
3. 9 or 6.
4. 8 or − 4.
5. $(\sqrt{4b^4 + a} + 2b)^{\frac{1}{n}}$.
6. $(\pm \sqrt{h - n + 4} - 2)^n$.
7. $(\pm \sqrt{16 + a + b} - 4)^n$.

EXERCISE 65.

1. 7 or − 4.
2. 12 or $-\frac{3}{4}$.
3. 4 or $-\frac{7}{4}$.
4. 4 or − 1.
5. 4 or $\frac{25}{12}$.
6. 12 or 6.
7. 21 or 5.
8. 1 or − 28.
9. 4 or 1.
10. 49 or $40\frac{1}{3}$.
11. 4 or $(-7)^{\frac{2}{3}}$.
12. 64 or $\left(-\frac{9}{2}\right)^{\frac{2}{3}}$.
13. 4 or − 1.
14. 1 or $1 \pm 2\sqrt{15}$.
15. 4 or 1.
16. 4, −3, or $\frac{1 \pm \sqrt{-43}}{2}$.
17. 9, 4, or $\frac{-3 \pm \sqrt{-7}}{2}$.
18. $\sqrt{\left(\frac{m \pm \sqrt{m^2 + 4n}}{2}\right)}$.
19. ± 2, − 8, or $-\frac{1}{4}$.
20. $\frac{b}{2} \pm \sqrt{\frac{4a^3 - b^3}{12b}}$.
21. 4 or $7\frac{1}{9}$.
22. 243 or $-28^{\frac{5}{7}}$.
23. 4 or − 25
24. 9a or − a.
25. 9 or − 12.
26. 2 or − 3.
27. 2 or $-\frac{15}{4}$.
28. 8 or $\frac{8}{7}$.
29. 9 or $(-5)^{\frac{2}{3}} + 5$.
30. 10 or − 2.

ITALIAN.—II.

[*Continued from p. 30.*]

THE SEMI-VOWELS (*continued*).

FIRST, the sharp sound of *s* may be said to be the ruling sound, because it is heard in the greater number of syllables and words. We shall invariably mark it by the single letter *s*; and wherever this is used, the reader will remember that it represents the sharp hissing sound of the letter. It has always the sharp hissing sound in the beginning of a word before a vowel; as, for example, *sale*, pronounced sáh-lai, salt; *sole*, só-lai, the sun; *sempre*, sêm-prai, always; *subito*, sóo-bee-to, suddenly. It has also the sharp hissing sound before the consonants *c, f, p, q*, and *t*: as, for example, in *scaltro*, skáhl-tro, shrewd; *sforzo*, sfôr-tzo, compulsion; *crespo*, krái-spo, crisp; *pasqua*, páh-skwah, Easter; *pasto*, páh-sto, a meal. It has also the sharp and hissing sound after the consonants *l, n*, and *r*, and we may say a pre-eminently hard and hissing sound in this case: as, for example, *falso*, fáhl-so, false; *corso*, kórr-so, course; *arso*, áhrr-so, burnt; *forse*, fórr-sai, perhaps; *pianse*, peeahn'-sai, he wept; *vinse*, vín-sai, he vanquished.

Secondly, the milder sound of the *s* occurs generally when it is placed between two vowels. As the nearest possible approach to it, we shall follow the practice of Walker's English pronouncing dictionary, and mark it with a *z*: for example, *avviso*, ahv-vée-zo, opinion; *guisa*, gwée-za, guise, manner; *tesoro*, tai-zò-ro, treasure; *usura*, oo-zóo-rah, usury, etc.

This rule is subject to several exceptions, the most important of which we must state here.

Many Italian adjectives end in *-oso* and *-ose*, and whenever before these terminations there is a vowel, the terminational *s* has the sharp hissing sound: as, for example, *glorioso*, pronounced glo-reeó-so; *virtuoso*, virr-tooó-so, virtuous; *tortuoso*, torr-tooó-so, tortuous.

In the greatest part of compound words, where *s* begins the syllable, it has the sharp hissing sound: as, for example, *proseguire*, pro-sai-gwée-rai, continue; *risolvere*, ree-sôl-vai-rai, to dissolve.

There are other exceptions which we shall take occasion to point out as examples occur.

Further, *s* has the mild sound when it immediately precedes the consonants *b, d, g, l, m, n, r, v*: as, for example, *sbarra*, pronounced zbáhrr-rah, bar, barrier; *sguardo*, zgwáhrr-do, look; *slontanare*, zlon-tah-náh-rai, to remove; *smania*, zmáh-neeah, madness; *snervare*, znerr-váh-rai, to unnerve; *sradicare*, zrah-dee-káh-rai, to eradicate; *svelto*, zvél-to, lively, clever, nimble, easy. There are many compound words in Italian, beginning with the particles *dis* and *mis*, and before consonants the final *s* of these particles must always have the sharp hissing sound, even before the last-mentioned consonants: for example, *disbandire*, pronounced dis-bahn-dée-rai, to banish; *disdire*, dis-dée-rai, to retract.

When *ss* is between two vowels, it does not follow the rule of the single *s*, but must be sounded with a sharp hissing sound: as, for example, *fosso*, pronounced fôs-so, a ditch, a canal; *rosso*, rós-so, red; *posso*, pós-so, I can.

We have not yet spoken of the letter *H*. It is named in the alphabet *acca* (pronounced ah'k-kah). According to its alphabetical sound, and because its two syllables are substantially one, only placed inversely, it might be classed as a semi-vowel; but as it is only an auxiliary letter to modify the sounds of *c* and *g*, as we shall have occasion to explain fully hereafter, it is a mere soundless, written sign, not a letter. It also serves to distinguish the words *ho*, I have, from *o*, or; *hai*, thou hast, from *ai*, dative plural of the article; *ha*, he has, from *a*, the preposition "to"; and *hanno*, they have, from *anno*, the year. This distinction is, however, only for the eye, for in pronouncing the *h* is quite mute; and some purists, headed by Metastasio, instead of an *h*, put the grave accent on those first four words.

The Italian has no aspirates, which essentially distinguishes it from the leading languages of Europe. Only in the middle, and at the end of some few interjections, a kind of aspiration is heard, which is only produced by the prolongation of the sound of the vowel, or of the transition of the voice from one vowel to another—principally, however, by a more emphatic emotion by which such interjections are thrown out: as, for example, *ah! ahi! deh! ahimè! eh! oh! ohi! ohi! ohimè! doh!*

The letters *K, W, X*, and *Y*, important letters in English, do not occur in Italian.

SECOND PRONOUNCING TABLE.

Showing the combination of Vowels with Semi-Vowels in Natural Order.

Italian.	*Pronounced.*	*English.*
Fere	fê-rai	Beasts
Refe	rái-fai	[illegible]
Foce	fo-tchai	Mouth (of a river).
Cefo	tchê-fo	A monkey.
Fugo	foo-go	I put to flight.
Gufo	góo-fo	A horned owl.
Lago	láh-go	Lake.
Gola	gó-lah	Throat.
Leso	laí-zo	Hurt.
Sole	só-lai	Sun.
Lice	lée-tchai	It is permitted.
Cieli	tchê-lee	The heavens.
Lode	lò-dai	Praise.
Delo	dê-lo	Delus.
Lume	lóo-mai	Light.

Italian.	*Pronounced.*	*English.*
Mule	móo-lai	Mules.
Maro	máh-ro	Wild basil.
Roma	ró-mah	Rome.
Mese	mái-zai	Month.
Seme	sái-mai	Seed.
Mira	mée-rah	The sight in artillery, aim.
Rami	ráh-mee	Branches.
Modo	mô-do	Manner, mode.
Domo	dô-mo	Tamed.
Muro	móo-ro	Wall.
Rumo	róo-mo	I reconsider.
Nave	náh-vai	Ship.
Vena	vái-nah	Vein.
Nera	nái-rah	Negress.
Rane	ráh-nai	Frogs.
Nice	née-tchai	Berenice, a woman's name.
Ceni	tchái-nee	Thou suppest.
Nome	nó-mai	Name.
Meno	mái-no	Less.
Nuca	nóo-kah	Nape of the neck.
Cuna	kóo-nah	Cradle.
Rado	ráh-do	Thin, rare.
Dora	dó-rah	He gilds.
Rese	rái-zai	Surrenders (of towns).
Sere	sê-rai	Sir.
Rido	rée-do	I laugh.
Dori	dó-ree	Thou gildest.
Roba	rô-bah	Property, victuals, merchandise. robe.
Baro	báh-ro	A cheat.
Rude	róo-dai	Rude.
Dure	dóo-rai	Durations.
Sara	sáh-rah	Sarah.
Rasa	ráh-zah	Erased.
Seco	sái-ko	With himself.
Cose	kô-sai	Things.

This is the plural of *cosa*, thing (pronounced kô-sah), one of those exceptional words where the *s* must be pronounced with a sharp hissing sound, though it is placed between two vowels.

Italian.	*Pronounced.*	*English.*
Sire	sée-rai	Formerly Sir, now Sire.
Reso	rai-zo	Rendered.
Soma	sô-mah	Burden.
Maso	máh-zo	Tom.
Beffare	bef-fáh-rai	To scoff.
Offeso	of-fái-zo	Offended.
Soffice	sóf-fee-tchai	Soft, flexible, supple.
Soffogo	sóf-fo-go	I suffocate.
Suffuso	soof-fóo-zo	Wetted.
Corallo	ko-ráhl-lo	Coral.
Vitello	vee-têl-lo	Calf.
Cavillo	kah-víl-lo	I annoy, quibble.
Satollo	sah-tól-lo	Satisfied, satiated, tired.
Catullo	kah-tóol-lo	Catullus.
Cenammo	tchai-náhm-mo	We supped.
Dilemma	dee-lêm-mah	Dilemma (logical).
Enimma	ai-ním-mah	Enigma.
Sommommo	som-môm-mo	A blow with the fist under the chin.
Affumo	ahf-fóo-mo	I smoke (meat).
Inganno	in-gáhn-no	Deceit.
Antenna	ahn-tên-nah	Yard (of a ship).
Erinni	ai-rín-nee	The Furies.
Aronne	ah-rôn-nai	Aaron.
Alunno	ah-lóon-no	Alumnus, pupil.
Caparra	kah-páhrr-rah	Earnest money.
Atterro	aht-terr-ro	I knock down.
Butirro	boo-tirr-ro	Butter.
Ricorro	ree-kórr-ro	I recur.
Azzurro	ah-dzóor-ro	Azure.
Abbasso	ahb-báhs-so	Low.
Ossesso	os-sês-so	Possessed, bored, dunned.
Affisso	ahf-fis-so	Affixed.
Indosso	in-dós-so	Upon the back.
Concusso	con-kóos-so	Moved, shaken, contrite.

THE DIPHTHONGS.

We have now to speak of the diphthongs; but before entering into details we may remark that these letters differ materially from the English, inasmuch as the two vowels forming a diphthong do not entirely merge into one sound, but are in Italian more or less distinctly heard, though only pronounced by one opening of the mouth, and with one emission of the air or voice, which gives them the value of one sound. This broad and general characteristic, however, prevails among all Italian diphthongs, that there must be a ruling sound, requiring a greater stress of the voice and more distinctness of utterance, which ruling sound is at one time on the first, at another on the second of the two vowels. In those diphthongs where the second of the two vowels is the ruling sound, the voice glides more rapidly from the first vowel to the second, and is, as it were, absorbed by it. The second is on that account heard with greater distinctness, and such diphthongs present more of a united sound; while in those diphthongs where the first of the two vowels is the ruling sound, the second is somewhat more distinctly heard than the first vowel of those diphthongs which approach to a united sound, though shortly and quickly trailed along, as it were, by the first.

The second kind or class may be termed, on this account, the *separated diphthongs*, the first class the *united diphthongs*—though we must caution the reader not to understand these words in their strictly literal sense; because, as stated before, in all Italian diphthongs the two vowels are more or less distinctly heard.

United diphthongs are, for example :—

ia, as in *fiato* (feeáh-to), breath ; *biada* (beeáh-dah), corn ; *piano* (peeáh-no), even, slow.

ie, as in *lieto* (leeê-to), cheerful; *bieco* (beeê-ko), squinting; *priego* (preeê-go), request, prayer.

io, as in *fiore* (feeó-rai), flower; *piove* (peeô-vai), it rains; *brioso* (bree-ó-so), lively; *chioma* (keeô-mah), head of hair.

iu, as in *più* (peeóo), more ; *fiume* (feeóo-mai), a river ; *schiuma* (skeeóo-mah), foam, scum.

ua, as in *guasto* (gwáh-sto), destruction ; *quà* (kwáh), here, hither; *quale* (kwáh-lai), who.

ue, as in *guerra* (gwêrr-rah), war; *Guelfo* (gwêl-fo), a Guelph ; *questo* (kwái-sto), this.

ui, as in *guisa* (gwée-zah), guise, manner; *Guido* (gwée-do), Guy ; *qui* (kwee), here.

uo, as in *cuore* (kooô-rai), heart; *suono* (sooô-no), sound; *uomo* (ooô-mo), man.

Separated diphthongs are, for example :—

ae, as in *aere* (áhai-rai). air, gas; *aerimante* (ahai-ree-máhn-tai), one who predicts by the air, or by aeromancy.

ai, as in *laido* (láhee-do), ugly; *maisì* (mahee-sée), yes, indeed.

ao, as in *Paolo* (páho-lo), Paul.

au, as in *aura* (áhoo-rah), a soft breeze; *lauro* (láhoo-ro), laurel; *fraudi* (fráhoo-dai), deceit; *fauno* (fáhoo-no), fawn; *causa* (káhoo-zah), a cause (at law), affair.

We have classed *au* as a separated diphthong where the first vowel is the ruling sound. There are, however, words containing that diphthong in which *u*, the second, is the ruling sound; thus, *paura* (pahóo-rah), fear; *baule* (bahóo-lai), portmanteau; *Saulle* (sahóol-lai), Saul. But even in this class of words *a* and *u* must be distinctly heard.

eo, as in *Eolo* (êo-lo), *Eolus*.

eu, as in *Europa* (aioo-rô-pah), Europe; *feudo* (fêoo-do), a feud or feoff; *Seleuco* (sai-lêoo-ko), Seleucus.

It must be noted that there are vowels which come together in words, but are, nevertheless, not diphthongs; as, for example, *coagulare* (ko-ah-goo-láh-rai), to coagulate; *coerente* (ko-ai-rên-tai), coherent; *caos* (káh-os), chaos.

THIRD PRONOUNCING TABLE.

Showing Words with Vowels in Coalition.

1. Words the same with regard to their letters, but different with regard to their syllables :—

Italian.	*Pronounced*	*English.*
Balia	báh-leeah	Nurse.
Balia	bah-lee-ah	Power, dominion.
Balio	báh-leeo	A tutor, foster-father.
Balio	bah-lee-o	Bailiff, steward, president
Bacio	bah-tcho	A kiss, I kiss.
Bacio	bah-tchee-o	A northern aspect.
Bugia	bóo-jah	He bores a hole, he lies.
Bugia	boo-jee-ah	A lie.
Empia	ém-peeah	Impious.
Empia (for *empiva*)	em-pee-ah	He filled.
Liscia	lee-shée-ah	Polished *or* smooth.
Liscia	lée shah	Smooth, sleek.
Viola	veeo-lah	Violet.
Viola	vee-o-lah	A little street.

2. Words nearly the same as respects letters, but different with regard to syllables .—

Italian.	*Pronounced.*	*English:*
Soffia	sóf-feeah	He blows.
Sofia	so-fée-ah	Sophia, a woman's name.
Malvagio	mahl-váh-jo	Wicked.
Malvagia	mahl-vah-jée-ah	Malmsey wine.
Primizia	pree-mee-tsee-ah	Firstlings of fruit *or* animals in sacrifice.
Primazia	pree-mah-tsée-ah	Primacy.
Erbaria	er-bah-ree-ah	Vegetable market.
Erbario	er-báh-reeo	Herbal.

3. General exercises in diphthongs :—

Italian.	*Pronounced.*	*English.*
Aere	áhai-rai	Air, gas.
Paese	pah-ái-zai	Country.
Laido	láhee-do	Ugly.
Caino	kah-ée-no	Cain.
Traino	tráhee-no	The trot of horses.
Traino	trah-ée-no	Sledge
Italian.	*Pronounced.*	*English.*
Linea	lée-nai-ah	A line.
Idea	ee-dé-ah	Idea.
Idee	ee-dê-ai	Ideas.
Linee	lée-nai-ai	Lines.
Sei	sé-ee	Six.
Omei	o-mê ee	Woes, sorrows.
Leone	lai-ó-nai	Lion.
Euro	êoo-ro	East wind.
Creusa	krai-óo-zah	Creusa, a woman's name.
Biada	beeáh-dah	Corn.
Diana	dee-ah-nah	Diana.
Cielo	tchê-lo	Heaven, horizon, the air.
Lieto	leeê to	Cheerful.
Paolo	páho-lo	Paul.
Fauno	fáhoo-no	Fawn.
Paura	pah-óo-rah	Fear.
Giove	jô-vai	Jove, Jupiter.
Dio	dée-o	God.
Giuda	jóo-dah	Judas.
Liuto	lee oo-to	Lute.
Oibo	oee-bô	Fie!
Annoi	ahn-nô-ee	Thou annoyest.
Quasi	kwah-zee	Almost, as it were.
Duale	doo-ah-lai	Dual.
Queto	kwê-to	Quiet, calm.
Duello	doo-êl-lo	Duel, fray.
Fluido	floóee-do	Fluid.
Luigi	loo-ee-jee	Lewis.
Luogo	loo-ô-go	Space, spot, locality.

FOURTH PRONOUNCING TABLE.

For Additional Exercise in the Vowels.

1. Words that contain *a*, *e*, *i*, *o*, or repeated *u* :—

Italian.	*Pronounced.*	*English.*
Abbacinata	ahb-bah-tchee-náh-tah	Dazzled.
Accanalata	ahk-kah-nah-láh-tah	Channelled (column).
Salamandra	sah lah máhn-drah	Salamander.
Cavalcava	kah-vahl-káh-vah	I rode
Persevererete	per-sai-vai-rai rái-tai	You will persevere.
Dipendentemente	dee-pen-den-tai-méntai	Dependently.
Pretenderete	prai-ten-dai-rái-tai	You will pretend.
Eccellentemente	et-tchel-len-tai-mén-tai	Excellently.
Insipidissimi	in-see-pee-dis see-mee	Most insipid.
Vicinissimi	vee-tchee-nís-see-mee	Very near *or* vicinal.
Inimicissimi	ee-nee-mee-tchís-see-mee	Very hostile *or* inimical.
Mirifici	mee-ree-fee-tchee	Wonderful, miraculous
Distintissimi	dee-stin-tís-see-mee	Very clear *or* distinct.
Difficilissimi	dif-fee-tchee-lís-see-mee	Very difficult.
Odoroso	o-do-ró-so	Fragrant, odorous.
Doloroso	do-lo-ró-so	Painful, dolorous.
*Pomocotogno**	po-mo-ko-tón-nyo	Quince.
Tumultuo	too-mool-too-o	I excite a tumult.
Usufruttuo	oo zoo-froot-too-o	I have temporary use of.

2. Words comprising five vowels :—

Italian.	*Pronounced.*	*English.*
Affettuosi	ahf-fet-too-ó-si	Kind, affectionate.
Communicare	kom-moo-nee-káh-rai	To communicate.
Delicatuzzo	dai-lee-kah-tóo tso	Over-refined, delicate.
Entusiasmo	en too zee-áh-zmo	Enthusiasm.
Fulminatore	fool-mee-nah-to-rai	One who fulminates.
Lusingheranno	loo-zin gai-rahn-no	They will flatter.
Procuratrice	pro-koo-rah-tree-tchai	A solicitor's wife.
Republicano	rai-poo-blee káh-no	Republican.
Saluberrimo	sah-loo-bêrr-ree-mo	Very wholesome.
Speculatori	spai-koo-lah-tó-ree	Thinkers, speculators.
Subordinare	soo-bor-dee-náh-rai	To subordinate.
Superlativo	soo per-lah-tée-vo	Highest, superlative.

PRONUNCIATION OF THE LETTERS *C*, *G*, *S*, IN COMBINATION WITH OTHER LETTERS.

WITH regard to the letters *c* and *g*, we have already stated and illustrated by examples in the first pronouncing table, that when *c* and *g* are placed before the vowels *a*, *o*, and *u*, *c* is sounded like *k*, and *g* like the English *g* in the words *game, go*, and *gull.* But suppose that it should be necessary in the declension of nouns, the conjugation of verbs, etc., to give to the *c* and *g* before the vowels *e* and *i* the same sound that *c* and *g* have before *a, o*, and *u*, the letter *h* must be used, which, being a mere soundless written sign, is on that account pre-eminently suited to the purpose. In this way we arrive at the combinations *ch* and *gh ;* and from what has been said it is obvious that the sound of *ch* before *e* and *i* can be no other than the sound of *k ;* and the sound of *gh* before *e* and *i*, that of *g* in the English words *game, go*, and *gull.* And this is a fundamental rule of the Italian grammar. For example, ***banche*** (pronounced báhn-kai), banks, offices ; ***stecchi*** (stêk-kee), thorns, prickles ; *Tedeschi* (tai-dái-skee), Germans ; *Turchi* (tóorr-kee), Turks ; *oche* (ô-kai), geese ; *vecchio* (vék-keeo), an old man ; *perchè* (per-kái), why, etc.

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* The sound of the *gn* will be explained later.

Hence another fundamental rule of Italian, which goes side by side with the one above stated, that whenever a necessity arises for giving to the *c* before *a, o*, and *u* the compressed sound of *c* in the English word *church*, and to *g* before *a, o*, and *u* the compressed sound of *g* in *ginger*, the letter *i* (an auxiliary letter in this case) must be placed between *c* and the vowels *a, o*, and *u*, and between *g* and the vowels *a, o*, and *u ;* and the combinations thus arising will be *cia, cio. ciu*, and *gia, gio, giu* (pronounced tchah, tcho, tchoo, and jah, jo, joo). For example, ***ciascuno*** (tchah-skoó-no), everybody ; ***ciancia*** (tcháhn-tchah), foolery ; *ciò* (tchô), that, what ; *ciuffo* (tchóof-fo), I catch, etc.

When *c* follows the letter *s*, thus forming the combination *sc*, and when at the same time it precedes the vowels *a, o*, and *u*, or the consonants *l* and *r*, it will be clearly apparent that the *c* in this case will follow the general rule, and be sounded like *k;* as *sca, sco, scu, scla*, etc., *scri*, etc. (pronounced skah, sko, skoo, sklah, etc., skree, etc.). When, however, the combination *sc* immediately precedes the vowels *e* and *i*, the sound of the *c* is less compressed than without the *s* before it ; and *sc* in such cases is sounded like *sh* in English words. The combinations *sce* and *sci* will therefore be pronounced shai, or shê, and shee. But when *c*, with an *s* before it and with *e* or *i* to follow, is to retain the sound of *k* just as before *a, o*, and *u*, recourse is had to the same auxiliary letter *h* to indicate the preservation of the sound of *c* like *k;* and the combinations *sche* and *schi* are pronounced skai, or skê, and skee. When, on the other hand, *c* with an *s* before it, and with the vowels *a, o*, and *u* to follow, is to be pronounced not like skah, sko, skoo, but like *sh*, recourse must be had to the letter *i*, which is interposed between *sc* and *a, o*, and *u*. Examples :—*Scarpa* (skáhrr-pah), shoe ; *scoppiare* (skop-peeáh-rai), to burst, crack ; *scuffia* (skóof-feeah), a woman's cap ; *scherno* (skérr-no), mockery ; *schifare* (skee-fáh-rai), to avoid, to have an aversion for ; *sclamare* (sklah-máh-rai), to exclaim ; *scrivere* (skrée-vai-rai), to write ; *scelto* (shél-to), selected ; *scevro* (shái-vro), separated ; *sciame* (sháh-mai), a swarm of bees ; *coscia* (kô-shah), thigh ; *sciolto* (shôl-to), ungirded ; *sciocco* (shôk-ko), stupid ; *asciutto* (ah-shóot-to), dry.

FIFTH PRONOUNCING TABLE.

1. *Che, Chi, Ghe, Ghi.*

Italian.	*Pronounced.*	*English.*
Cheto	kái-to	Quiet.
Chino	kée-no	Bent.
Ghetto	ghét-to	Jewry.
Ghiro	ghée-ro	Dormouse.
Rachele	rah-kê-lai	Rachel.
Archimede	ahrr-kee-mê-dai	Archimedes.
Vogherà	vo-gai-ráh	He will row.
Foche	fô-kai	Sea-calves.
Fichi	fee-kee	Fig-trees.
Leghe	lai-gai	Leagues, alliances.
Laghi	láh-ghee	Lakes.

2. *Chia, Chie, Chio, Chiu.*

Italian.	*Pronounced.*	*English.*
Chiaro	keeáh-ro	Clear, bright.
Chiesa	keeai-zah	Church.
Chiodo	keeó-do	Nail.
Chiuso	keeoo-zo	Inclosed, inclosure.
Tarchiato	tahrr-keeáh-to	Plump, fat.
Banchierè	bahn-keeê-rai	Banker.
Melchiorre	mel-keeórr-rai	Melchior.
Conchiuso	kon-keeóo-zo	Concluded.
Vecchia	vêk-keeah	An old woman.
Secchie	sek-keeai	Buckets.
Succhio	soók-keeo	Augur, juice.
Schiuma	skeeó-mah	Froth, scum.

3. *Ghia, Ghie, Ghio.*

Italian.	*Pronounced.*	*English.*
Ghiera	gheeê-rah	A ferrule.
Ghiova	gheeô-vah	Clod, turf.
Ringhiare	rin-gheeáh-rai	To snarl.
Preghiera	prai-gheeê-rah	Prayer, desire.
Singhiozzo	sin-gheeó-tso	Sob, sigh, hiccough.
Cinghia	tchin-gheeah	Girth.
Unghie	oon-gheeai	Nails, hoofs.
Ringhio	rin-gheeo	I grin, grinding the teeth.

4. *Cia, Cie, Ci, Cio, Ciu ; Gia, Gie, Gi, Gio, Giu.*

Italian.	*Pronounced.*	*English.*
Ciano	tcháh-no	Blue-bottle (plant).
Ciera	tchái-rah	The look, face.

The vowel *i* before *e*, when both follow the consonant *c*, is pronounced as though the *i* was not there, and the whole combination only *ce.* The same remark, however, made with regard to the combinations *cia, cio*, and *ciu*—that in a more measured enunciation the vowel *i* in these cases is slightly touched—holds good here also.

Italian.	*Pronounced.*	*English.*
Ciofo	tchô-fo	A mean fellow.
Ciuco	tchóo-ko	
Giara	jáh-rah	Jar.
Gielo	jé-lo	Ice, frost, cold.

The observation just made in the foregoing note with respect to *cie* is strictly applicable to the syllable *gie.*

Italian.	*Pronounced.*	*English.*
Giove	jó-vai	Jove, Jupiter.
Giuda	jóo-dah	Judah.
Baciare	bah-tcháh-rai	To kiss, salute.
Arciere	ahrr-tchê-rai	Bowman, archer.
Arcione	ahrr-tcho-nai	Saddle-bow, saddle.
Acciuga	aht-tchoo-gah	Anchovy.

No observation has yet been made in reference to the pronunciation of the double *c* (*cc*). This depends, as well as the pronunciation of double *g* (*gg*), on the vowel that follows the latter *c*. If, however, that vowel which follows the letter *c* is *e* or *i*, the double *c* (*cc*) is sounded something like *tch* in the English word *match*, only perhaps stronger, and with vibration. On that account, we have tried to imitate the stronger sound of the *cc* by the letters *ttch*, placing the first *t* in the first syllable, and *tch* at the beginning of the second, just as we have attempted to imitate the sound of the *gg* by placing *d* in one syllable and *j* at the beginning of the next in such words as *paggi* (páhd-jee), pages, attendants.

Italian.	*Pronounced.*	*English.*
Fagiano	fah-jah-no	Pheasant.
Ingiusto	in-joo-sto	Unjust.
Pancia	pahn-tchah	Belly, paunch.
Specie	spê-tchai	Kind, species.
Lercio	lérr-tcho	Dirty, foul.
Ciuffo	tchoof-fo	Tuft, lock of hair.
Regia	rê-jah	Royal palace.
Ruggito	rood-jee-to	Roaring.
Giulio	joo-leeo	A Roman coin, July.

5. *Gua, Gue, Gui, Guo; Qua, Que, Qui, Quo.*

Italian.	*Pronounced.*	*English.*
Guado	gwah-do	A ford.
Guelfo	gwêl-fo	A Guelph, an ancient coin of Florence.
Guida	gwée-dah	Leader, guide.
Seguo	sê-gwo	I follow *or* pursue.
Quasi	kwah-zee	Almost, as if.
Questo	kwái-sto	This.
Quito	kwee-to	I acquit, free.
Quoio	kwô-yo	Leather, skin.
Seguace	sai-gwah-tchai	Follower, disciple.
Insegue	in-sê-gwai	He pursues.
Liquori	lee-kwô-ree	Liquors.
Acquario	ah-kwah reeo	Aquarius.
Lequela	lo-kwê-lah	Speech.
Aquila	áh-kwee-lah	Eagle.
Acquoso	ah-kwo-so	Aqueous, watery.
Lingua	lín-gwah	Tongue, language.
Sangue	sahn-gwai	Blood.
Pingue	pin-gwai	Fat, plump.
Pasqua	páh-skwah	Easter.
Cinque	tchin-kwai	Five.
Iniquo	ee-nee-kwo	Unjust, iniquitous.
Adequi	ah-dé-kwee	Thou comparest.

6. *Cla, Cle, Cli, Clo, Clu; Gla, Gle, Gli, Glo, Glu.*

Italian.	*Pronounced.*	*English.*
Clava	klah-vah	Club.
Clero	klé-ro	Clergy.
Clima	klee-mah	Climate.
Cloto	klô-to	Clotho, one of the Fates.
Clusio	kloó-zeeo	Clusium, a town.
Gladio	gláh-deeo	Sword, poniard.
Gleba	glê-bah	Clod of earth.
Glifo	glí-fo	Glyph (in architecture).
Globo	glô-bo	Globe.
Gluma	gloó-mah	Chaff.
Reclamo	rai-kláh-mo	Reclamation.

This is the first occurrence in these lessons of the important combination *gl*. It has two different sounds. When it is not followed by the letter *i* it has the sound of *gl* in *gland*, *glebe*, *glory*, *glue*; and this sound can offer no difficulty. But when the combination *gl* is followed by the letter *i* and one of the vowels *a*, *e*, *o*, and *u*, it is pronounced precisely as the double *l* (*ll*) in the French words *bouilli*, *fille*, *grésiller*, *grenouille*, *bouillon*, *billard*, *billet*, *brouillon*, *feuillu*, and, generally speaking, in all those words where the *ll* has after the vowel *i* a squeezed sound in the French language. They who are unacquainted with French may form a notion of this sound by separating and inverting the *gl* in the enunciation, that is, by pronouncing *ll* before the *g*, and changing the latter into *y*. Only the first *l* must go to one syllable, and the second *l* along with the *y*, and with a squeezed sound to the beginning of the next, while care must be taken that the voice should glide rapidly from one syllable to the other, by which means a more equal distribution of the squeezed sound *lly* will be produced, and a correct pronunciation of the *gl* effected. An approximation to this sound may be found in the English words *million*, *miliary*, *biliary*, *billiards*, *seraglio*, *intaglio*, and *oglio*. The letter *i*, between the combination *gl* and the vowels *a*, *e*, *o*, and *u*, is (as well as in the combinations *cia*, *cio*, *ciu*, and *gia*, *gio*, *giu*) a mere soundless written sign, to indicate that *gl* before *a*, *e*, *o*, and *u*, is not to have the sound of *gl* in *gland*, *glebe*, *glory*, and *glue*, but that squeezed sound the imitation and description of which we have here attempted.

For example: *vaglio* (váhl-lyo), a sieve; *meglio* (mêl-lyo), better; *piglio* (píl-lyo), I take, seize; *miscuglio* (mis-kóol-lyo), mixture; *svegliare* (zvel-lyáh-rai), to awake; *togliere* (tôl-lyai-rai), to take away; *scegliere* (shél-lyai-rai), to choose; *doglia* (dôl-lyah), sorrows; *bigliardo* (bil-lyáhrr-do), billiards; *biglietto* (bil-lyét-to), note, bill; *imbroglione* (im-brol-lyó-nai), a meddling fellow; *fogliuto* (fol-lyoó-to); full of leaves. *Egli*, he; *eglino*, they; *quegli*, that one; *gli* (the plural of the article or the pronoun), with its numerous compositions, and *gli*, the final inflection or terminational syllable of nouns and verbs, have always the squeezed sound *llyee*; while the mere syllable *gli*, at the commencement and in the middle of words, always has the sound of *gl* in *gland*, *glebe*, etc. The only exception is *Angli*, Englishmen (pronounced áhn-glee).

7. *Gna, Gne, Gni, Gno, Gnu.*

Gn is a combination almost as important as *gl*. *G* before *n* must never be omitted to be sounded, as in the English words *gnaw*, *gnat*, etc.; but

Englishmen are apt to forget this, and to sound the combination *gn* in several foreign languages as if no *g* were before the *n*. The combination *gn* must, likewise, never be sounded as *gn* in the English words *signify*, *malignity*, *assignation*, and so on. Those who know French will be able to sound *gn* at once by bearing in mind the correct pronunciation of *gn* in the French words *mignon*, *mignard*, etc., with which the Italian pronunciation of *gn* exactly agrees. Those who do not understand French may form a notion of the sound by the same operation pointed out in our explanation of the sound *gl*. They must, as it were, sound the *n* before the *g*, and change the latter into *y*; only taking care that the voice should glide rapidly from *n* to *y*, and squeeze, as it were, these two letters into one very mild enunciation. This very mild enunciation of the squeezed sound *gn* is a peculiarity of the Italian language. The best illustration is the word *cognac*.

We shall try to imitate the sound *gn* by the letters *nny*; and where in Italian words the *gn* occurs in the middle and at the end, the first *n* must go in some respects to one syllable, and the second *n* along with the *y* to the next, the voice rapidly gliding from one of those syllables to the other in the way we have already stated. For example, *campagna* (pronounced kahm-páhn-nyah), country; *vegnente* (ven-nyên-tai), future, next; *Giugno* (joón-nyo), June; *gnocchi* (nyôk-kee), small dumplings, clowns; *scrigno* (skrín-nyno), bunch, a coffer; *Spagnuolo* (Spahn-nyooô-lo), a Spaniard. We must not omit the remark that foreigners, in Italian pronunciation, are apt to confound the two combinations *gn* and *ng* as though they were the same. This is not the case. In uttering *gn*, the *g* must be converted into *y* and sounded after *n*, and the combination *gn* always retains its peculiar sound irrespective of the vowels that may follow; while in uttering *ng*, the *g* retains the natural sound depending on the vowel that follows. For example: *Giugno* (joón-nyo), June, and *giungo* (joón-go), I arrive, I join; *pugno* (poón-nyo), fist, cuff, I fight, and *pungo* (poón-go), I sting. As a last remark on the *gn*, we have to note that when *gn* is followed by the letter *i*, it is a sign that *gni* is to form a syllable by itself; and the *i* in such cases is never a mere soundless written sign to indicate that *gn* is to have a squeezed sound, because *gn* has naturally, and without any exception, a squeezed sound. This is quite different in the combination *gl*, and makes the essential difference between the combinations *gl* and *gn*. For example, *compagnia* (pronounced kom-pahn-nyeé-ah), company, certainly differing from the word *compagna* already stated.

Italian.	*Pronounced.*	*English.**
Gnao	nyáh-o	Mewing of cats.
Gneo	nyé-o	*Gnejus.
Gnido	nyée-do	Gnidus, a town of Caria.
Gnome	nyô-mai	A gnome.
Gnuno	nyóo-no	Nobody, not one.
Bagno	báhn-nyo	Bathing-place, bath.
Segno	sen nyo	Sign.
Cigno	tchin-nyo	Swan, cygnet.
Sogno	són-nyo	Dream.
Pugno	póon-nyo	Fist, cuff, I fight.
Cognato	kon-nyáh-to	Brother-in-law.
Pignere	pin-nyai-rai	To push.
Cognit	kôn-nyee-to	Known
Signore	sin-nyó-rai	Sir.
Ognuno	on-nyóo-no	Everybody

8. *Sca*, *Sce*, *Sci*, *Sco*, *Scu*.

Italian.	*Pronounced.*	*English.*
Scabro	skah-bro	Rough.
Pesca	pai-skah	Fishing, fishery.
Pesca	pê-skah	Peach.
Scemo	shái-mo	Diminution, diminished, I diminish.
Bisce	bee-shai	Snakes
Scipa	shee-pah	An ignorant man.
Fasci	fáh-shee	Bundles, fasces.
Scoglio	skôl-lyo	Shell, rock, danger.
Bosco	bó-sko	Forest, wood.
Scucio	skoo-tcho	I undo something sewn, I rip.
Scuro	skoo-ro	Obscure.

9. *Sch*, *Scia*, *Scie*, *Scio*, *Sciu*, *Scr*, *Sg*, *Sgh*, *Sq*.

Italian.	*Pronounced.*	*English.*
Schiatta	skeeáht-tah	Issue, progeny, generation, race.
Schietto	skeeet-to	Pure, unmixed, candid, sincere, ingenuous.
Fischi	fee-skee	Whistles.
Schioppo	skeeóp-po	Gun.
Schiuma	skeeoo-mah	Froth, scum.
Sciame	sháh-mai	Swarm of bees.
Scienza	shen-tsah	Science.
Sciocco	shok-ko	Stupid, a fool.
Sciupa	shoo-pah	He wastes, spoils
Scranna	skráhn nah	Camp-stool, folding-chair.
Screzio	skrê-tseeo	Discord, quarrel.
Scrigno	skrin-nyo	Bunch; coffer.
Scrofa	skrô-fah	A sow
Scruto	skroo-to	I scrutinise.
Sgarro	zgáhrr-ro	Error.
Sgherro	zgherr-ro	A hector, bully
Sghigno	zghin-nyo	I sneer.
Sgorbio	zgorr-beeo	Spot of ink.
Sgusto	zgoo-sto	I get tired of.
Sguscio	zgoo-sho	I shell.
Squadra	skwáh-drah	A square (instrument), squadron.

We have repeatedly in these lessons marked the combinations *gua*, *gue*, *gui*, *guo*, and the combinations *qua*, *que*, *qui*, *quo*, with "gwah . . ." and "kwah . . ." We must, however, warn the reader not to give to the *w* in these cases the full and legitimate sound of the English *w*, which is peculiar to the English language. We might have marked these combinations "gvah . . ." and "qvah . . .," and so they are marked by the distinguished grammarian, Abate Flario Casarotti, and other writers on Italian grammar; but the Italian *v* is a softer sound than the English—a kind of medium sound between the *w* and the English *v*. On this account we have thought it more advisable to mark these combinations with *w* instead of *v*, and if the reader will avoid the peculiarity of the pronunciation of the English *w* (pronounced with a forward motion and instant withdrawal of the lips), pronouncing it more like a softer *v*, he will approach the true sound.

Italian.	*Pronounced.*	*English.*
Squillo	skwíl-lo	Sound, gimlet.
Pasquale	pah-skwáh-lai	Paschal.
Risquoto	ree-skwô-to	I exact, I redeem, I shudder.
Inclito	in-klee-to	Renowned.
Ciclope	tchee-klô-pai	Cyclops.
Recluta	rai-kloó-tah	Recruiting.
Inglese	in-glái-zai	Englishman.
Anglicano	ahn-glee-káh-no	Anglican.
Egloga	ê-glo-gah	Eclogue.
Ingluvie	in-gloó-veeai	Voracity.
Tecla	tê-klah	Thecla (a woman's name).
Cieli	tchê-lee	Skies, heaven.
Siclo	sée-klo	Shekel (a Hebrew coin and weight).
Egla	ê-glah	Egla, a name.
Angli	áhn-glee	Englishmen.
Anglo	áhn-glo	Englishman
Glutine	gloó-tee-nai	Glue, birdlime.

10. *Glia, Glie, Glio, Gli.*

Italian.	*Pronounced.*	*English.*
Tovaglia	to-váhl-lyah	Table cloth, towel
Oneglia	o-nêl-lyah	Oneglia, a town in Sardinia.
Famiglia	fah-míl-lyah	Family.
Invoglia	in-vôl-lyah	Wrapper.
Aguglia	ah-goól-lyah	Needle.
Paglie	páhl-lyai	Straws.
Veglie	váil-lyai	Vigils, evening parties.
Figlie	fíl-lyai	Daughters.
Moglie	mól-lyai	Wife.
Guglie	goól lyai	Obelisks.
Vaglio	vahl-lyo	Sieve, I sift.
Veglio	vêl-lyo	An old man.
Giglio	jil-lyo	Lily.
Loglio	lôl-lyo	Cockle-weed.
Luglio	loól-lyo	July.
Ragli	rahl-lyee	Rays.
Vegli	vêl-lyee	Old men.
Tigli	tíl-lyee	Linden-trees.
Sogli	sôl-lyee	Thrones.
Fugli	fool-lyee	Was to him.

ELOCUTION.—VII.

[*Continued from p* 43]

EXERCISES ON INFLECTIONS.

Rising Inflection.

Rule 1.—High rising inflection :—

Há !—say you *só ?*
What !—confer a *crówn* on the author of the public calamities?
Indéed !—acknowledge a *tráitor* for our sovereign ?

Rule 2.—Moderate rising inflection :—

In every station which Washington was called to fill, he acquittéd himself with honour.

As the evening was now far advánced, the party broke up.

Where your tréasure is, there will your héart be ˈ also.

Though we cannot discern the reasons which regulate the occurrence of evénts, we may rest assured that nothing can happen without the cognisance of Infinite Wisdom.

Despairing of any way of escape from the perils which surróunded him, he abandoned his struggles, and gave himself up to what seemed his inevitable doom.

Had I suffered such enormities to pass unpúnished, I should have deemed myself recreant to every principle of justice and of duty.

Note and Exception.—Words and phrases of address :—

Listen, Amèricans, to the lesson which seems borne to us on the very air we brèathe, while we perform these dutiful rites. Ye winds, that wafted the pilgrims to the land of pròmise, fan, in thèir children's hearts, the love of frèedom ! Blood which our fàthers shed, cry from the gròund ;—echoing arches of this renowned hàll, whisper back the voices of other dàys ;—glorious Wàshington ! break the long silence of that votive cànvas ;—spèak, spèak, marble lips : teach US THE LOVE OF LIBERTY PROTECTED BY LAW !

Rule 3.—*Note.*—Poetic series :—

Pŏwer, wĭll, sensătion, mémory, failed in turn.
Oh ! the dread mingling, in that awful hour,
Of all terrific sounds !—the savage tone
Of the wild hŏrn, the cannon's pĕal, the shower
Of hissing dărts, the crash of walls o'erthrówn,
The dĕep, dŭll, tàmbour's beat !
All the while,
A ceaseless murmur from the populous town,
Swells o'er these solitudes ; a mingled sound
Of jarring whĕels, and iron hoofs that clash
Upon the stony wăys, and hammer clăng,
And creak of engines lifting ponderous bŭlks,
And călls and cries,* and tread of eager feet
Innŭmerable, hurrying to and frò.

Onward still the remote Pawnee and Mandan will beckon, whither the deer are fly̆ing, and the wild horse rŏams, where the buffalo rănges, and the condor sŏars,—far towards the wàves where the stars plunge at midnight, and amid which bloom those ideal scenes for the persecuted săvage, where white men will murder no more for gold,* nor startle the game upon the sunshine hills.

Rule 4.—Questions which may be answered by *Yes* or *No* :—

Has not the patronage of peers incréased? Is not the patronage of India now vested in the crówn? Are all these innovations to be made to increase the influence of the exécutive power ; and is nothing to be done in favour of the pópular part of the constitution, to act as a counterpoise?

Your steps were hasty ;—did you speed for nóthing?
Your breath is scanty ;—was it spent for nóthing?
Your looks imply concern ;—concern for nóthing?

Exception.—Emphasis :—

Tell me not of the honour of belonging to a free country,—I ask, does our liberty bear *generous frùits ?*

Was there a village or a hamlet on Massachusetts Bày, which did not gather its hardy seamen to man the gun-decks of your ships of war? Did they not rally to the battle, as men flock to a fèast ?

Is there a man amòng you, so lost to his dignity and his dùty, as to withhold his aid at a moment like this?

Rule 5.—Penultimate Inflection :—

All is dòubt, distrúst,* and disgràce ; and, in this instance, rely on it, that the certain and fatal result will be to make Ireland hate the connection, contemn the cóuncils of England and despise her pòwer.

I am at a loss to reconcile the conduct of men, who, at this moment, rise up as champions of the East India Company's charter; although the incompetence of that company to an adequate discharge of the trust deposited in them are themes of ridicule and contempt to all the wòrld; and although, in consequence of their mismànagement, connivance, and imbecility, combined with the wickedness of their servants, the very name of an Englishman is detested, even to a proverb, through all A'sia ; and the national character is become disgraced and dishonoured.

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* The penultimate inflection of a concluding series, or of a clause that forms perfect sense, is the same in kind with that which precedes a period, except in verse and poetic prose, which, in long passages of great beauty, retain the suspensive slide.

It will be the duty of the historian and the sage, in all ages, to omit no occasion of commemorating that illustrious màn ; and, till time shall be no mòre, will a test of the progress which our race made in wisdom and in virtue be derived from the veneration paid to the immortal name of Washington.

Exception.—Emphasis :—

Let us bless and hallow our dwellings as the homes of freedom. Let us make them, too, the homes of a nòbler freedom,—of freedom from vice, from evil pàssion,—from every corrupting boudage of the soul !

If guilty, let us calmly abide the results, and peaceably submit to our sentence ; but if we are traduced, and really be innocent, tell ministers the truth—tell them they are tyrànts ; and strain every effort to avert their oppression.

Heaven has imprinted in the mother's face, something beyònd this world, something which claims kindred with the skies,—the angelic smile, the tender lòok, the wàking, watchful eye, which keeps its fond vigil over her slumbering bàbe.—In the heart of man lies this lovely picture ; it lives in his sympathies ; it reigns in his affèctions ; his eye looks round, in vain, for such another object on èarth.

Falling Inflection.

Rule 1.—Intensive downward slide :—

Ùp ! all ye who love me ! BLOW *on* BLÒW.
And lay the outlawed felons LÒW !

" MACGRÈGOR ! MACGRÈGOR ! " he bitterly cried.

ÒN ! countrymen, ÒN !—for the day,—
The proud day of glòry,—is come !

To ÀRMS ! gallant Frenchmen, to ÀRMS !

Oh ! SHÀME on us, countrymen, shame on us ÀLL !
If we cringe to so dastard a race !

TRÈMBLE, ye traitors ! whose schemes
Are alike by all parties abhorred,—
TREMBLE ! for, roused from your parricide dreams,
Ye shall soon meet your fitting reward !

Rule 2.—Full falling inflection, in the cadence of a sentence :—

The changes of the year impart a colour and character to our thoughts and fèelings.

To a lover of nature and of wisdom, the vicissitude of seasons conveys a proof and exhibition of the wise and benevolent contrivance of the Author of àll things.

He who can approach the cradle of sleeping innocence without thinking that "of such is the kingdom of heaven," or see the fond parent hang over its beauties, and half retain her breath, lest she should break its slumbers,—without a veneration beyond all common feeling,—is to be avoided in every intercourse of life, and is fit only for the shadow of darkness, and the solitude of the dèsert.

Exception.—Modified cadence :—

This monument is a plain shaft. It bears no inscription, fronting the rising sun, from which the future antiquarian shall wipe the dùst. Nor does the rising sun cause tones of music to issue from its sùmmit. But at the rising of the sun, and at the setting of the sun, in the blaze of noon-day, and beneath the milder effulgence of lunar light, it speaks, it acts, to the full comprehension of every British mind, and the awakening of glowing enthusiasm in every British heart.

I speak not to you, sir, of your own outcast condition.—You perhaps delight in the perils of martyrdom. I speak not to those around me, who, in their persons, their substance, and their families, have endured the torture, poverty, ànd irremedial dishònour. They may be meek and hàllowed men,—willing to endure.

The foundation on which you have built your hopes may seem to you deep and firm. But the swelling flòod, and the howling blàst, and the beating ràin, will prove it to be but treacherous sànd.

Rule 3.—Moderate falling inflection of complete sense :—

Joy is too brilliant a thing to be confined within our own bòsoms : it burnishes all nàture, and, with its vivid colouring, gives a kind of fàctitious life to objects without sense or motion.

When men are wanting, we address the ànimal creation ; and, rather than have none to partake our feelings, we find sentiment in the music of birds, the hum of insects, and the lowing of kine ; nay, we call on rocks and streams and forests to witness and share our emotions.

I have done my dùty :—I stand acquitted to my conscience and my còuntry :—I have opposed this measure throughòut ; and I now protest against it, as hàrsh, opprèssive, uncàlled for, unjùst,—as establishing an infamous precedent, by retaliating crime against crime,—as tyrannous,—crùelly and vindictively tyrannous.

Exception.—Plaintive expression :—

I see the cloud and the tempest near
The voice ŏf the troubled tide I hĕar ;
The torrent of sŏrrow, the sea of grief,
The rushing waves of a wretched life.

No deep-mouthed hound the hunter's haunt betrayed,
No lights upon the shore or waters plăyed ;
No loud laugh broke upon the silent ăir,
To tell the wanderers man was nestling there.

The dead leaves strew the forest wălk,
  And withered are the pale wild flŏwers ;
The frost hangs blackĕning on the stălk,
  The dew-drops fall in frozen shŏwers :—
  Gone are the Spring's green sprouting bŏwers.
Gone Summer's rich and mantling vines ;
  And Aŭtumn, with her yellow hŏurs,
On hill and plain no longer shines.

What is human life, but a waking dream,—a long reverie—in which we walk as "in a vain show, and disquiet ourselves for naught ?" In childhood we are surrounded by a dim, unconscious present, in which all palpable realities seem for ever to elude our grăsp ; in youth, we are but gazing into the far future of that life for which we are consciously prepăring ; in manhood, we are lost in ceaseless activity and enterprise, and already looking forward to a season of quiet and repose, in which we are to find ourselves, and listen to a voice withín ; and in old age, we are dwelling on the shadows of the pàst,* and gilding them with the evanescent glow which emanates from the setting sun of life.

Rule 4 and Note 1.—Simple commencing series :—

The ŏld and the yóung are alike exposed to the shafts of Death.

The hĕalthy, the tĕmperate, and the virtuous enjoy the true relish of pleasure.

Birth, rănk, wĕalth, léarning are advantages of slight value, if unaccompanied by personal worth.

* Falling slide of contrast to the preceding clause.

Gĕntleness, pătience, kindness, cándour, and cóurtesy, form the elements of every truly amiable character.

Sy̆mpathy, disinterĕstedness, magnanimity, generŏsity, liberălity, and self-forgétfulness, are qualities which universally secure the esteem and admiration of mankind.

Compound commencing series :—

In a rich sŏil, and under a soft climate, the weeds of luxury will spring up amid the flowers of art.

All the wise instructions of the lăwgiver, all the doctrines of the săge, all the ennobling strains of the póet, had perished in the ear, like a dream related, if letters had not preserved them.

The dimensions and distances of the planets, the causes of their revolŭtions, the path of cŏmets, and the ebbing and flowing of tides, are now understood and explained.

The mighty pyramid, half buried in the sands of Africa, has nothing to bring down and report to us, but the power of kings, and the servitude of the people. If asked for its móral object, its admonition,* its sĕntiment, its instruction to mankind, or any high énd in its erection, it is silent ; silent as the millions which lie in the dust at its base, and in the catacombs which surround it.

Yes,—let me be frèe ;† let me go and come at my own will ; let me do business, and make journeys, without a vexatious police or insolent soldiery to watch my steps ; let me think, and do, and speak what I please, subject to no limit but that which is set by the common weal ; subject to no law but that which cónscience binds upon me ; and I will bless my country, and love its most rugged rocks, and its most barren soil.

Exception 3.—Poetic and pathetic series :—

Whereso'er thy lot command,
  Brŏther, pilgrim, stranger,
God is ever near at hand,
  Golden shield from danger.

Rocks of grănite, gates of brăss,
  Alps to heaven sóaring,
Bow, to let the wishes pass
  Of a soul imploring.

From the phantoms of the night,
Dreaming hŏrror, pale affright,
Thoughts which rack the slumbering breast,
Fears which haunt the realm of rĕst,
And the wounded mind's remŏrse,
And the tempter's secret fórce,
Hide us 'neath Thy mercy's shade.

From the stars of hĕaven, and the flowers of ĕarth ;
From the pageant of pŏwer, and the voice of mirth ;
From the mist of the morn on the mountain's brŏw ;
From childhood's song, and affection's vŏw ;
From all save that o'er which soul ‡ bears sway
There breathes but one record,—" passing away ! "

When the summer exhibits the whole force of active nature, and shines in full beauty and splĕndour ; when the succeeding season offers its " purple stores and golden grain," or displays its blended and softened tints ; when the winter puts on its sullen aspect, and brings stillness and repose, affording a respite from the labours which have occupied the preceding months, inviting us to reflection, and compensating for the want of attractions abroad, by fireside delights and home-felt joys ; in all this interchange and variety, we find reason to acknowledge the wise and benevolent care of the God of seasons.

In that solemn hour, when exhausted nature can no longer sustăin itself ; when the light of the eye is waxing dim ; when the pulse of life is becoming low and făint ; when the breath labours, and the tongue fălters ; when the shadow of death is falling on all outward things, and darkness is beginning to gather over the faces of the loved ones who are weeping by his bédside, a ray of immortal hope is beaming from his features : it is a Christian who is expiring.

Note 2.—Repeated and heightening rising inflection :—

I ask, will you in silence permit this invasion of your rights, at once wánton, mischievous, uncálled for, and unnécessary ? Will you patiently tolerate the annihilation of all fréedom,—the appointment of a supreme dictátor, who may, at his will, suspend all your rights, liberties, and privileges ? Will you, without a murmur of dissent, submit to a tyranny which nearly equals that of the Russian áutocrat, and is second to that of Bonaparte ? ‡

Repeated and increasing falling inflection § :—

Was it the winter's stórm, beating upon the houseless heads of women and children ? was it hard labour and spare mèals ? was it disease ? was it the tòmahawk ? was it the deep malady of a blighted hòpe, a ruined énterprise, and a broken hèart ?—was it sóme, or all of these united, that hurried this forsaken company to their melancholy fate ?

Yes, after he has destroyed my belief in the superintending providence of Gòd,—after he has taught me that the prospect of a hereafter is but the baseless fabric of a vision,—after he has bred and nourished in me a contempt for that sacred volume which alone throws light over this benighted world,—after having argued me out of my faith by his sophistries, or laughed me out of it by his ridicule,—after having thus wrung from my soul every dròp of consolation, and dried up my very spirit within me ;—yes, after having accomplished this in the season of my health and my prosperity, the sceptic would come to me while I mourn, and treat me like a drivelling idiot, whom he may sport with, because he has ruined me, and to whom, in the plenitude of his compassion—too late and too unavailing—he may talk of truths in which he himself does not believe, and which he has long exhorted me, and has at last persuaded me, to cast away as the dreams and delusions of human folly

Simple concluding series :—

It is a subject interesting alike to the óld and to the yòung.

Nature, by the very disposition of her elements, has commanded, as it were, and imposed upon men, at moderate intervals, a general intermission of their tŏils, their occupátions, and their pursŭits.

The influence of true religion is mild, and sŏft, and nóiseless, and cònstant, as the descent of the evening dew on the tender

* All the emphatic series, even in suppositive and conditional expression, being, like enumeration, cumulative in effect, and corresponding therefore to climax in style, are properly read with a prevailing downward slide in the "suspensive" or slight form, which belongs to incomplete but energetic expression, and avoids, accordingly, the low inflection of cadence at a period.

† Emphasis, and length of clause, may substitute the "moderate" falling slide for the slight "suspensive" one. But the tone, in such cases, will still be perfectly free from the descent of a cadence, which belongs only to the period.

‡ The inflection of any clause always lies on the emphatic word ; and if that word is a polysyllable, on the accented syllable chiefly, although not always exclusively.

§ This inflection both begins higher, and ends lower, every time it is repeated.

herbage, nourishing and refreshing all the amiable and social virtues; 'but enthusiasm is viŏlent, sŭdden, rattling as a summer shŏwer, rooting up the fairest flówers, and washing away the richest mòuld, in the pleasant garden of society.

Compound concluding series :—

The winter of the good man's age is cheered with pleasing reflections óf the pást, and bright hopes of the fùture.

It was a moment replete with jŏy, amázement, and anxiety.

Nothing would tend more to remove apologies for inattention to religion, than a fair, impartial, and full account of the educătion, the chăracters, the intellectual prócesses, and the dying mòments of those who offer them.

Then it would be seen that they had gained by their scepticism no new plĕasures, no tranquillity of mind, no peace of conscience during life, and no consolation in the hour of dèath.

Well-doing is the cause of a just sense of elevation of chăracter; it clears and strengthens the spirits; it gives higher riches of thŏught; its widens our benevolence, and makes the current of our peculiar affections swift and deep.

A distant sail, gliding along the edge of the ocean, was sometimes a theme of speculation. How interesting this fragment of a world, hastening to rejoin the great mass of existence! What a glorious monument of human invention, that has thus triumphed over wind and wăve; has brought the ends of the earth in communion; has established an interchange of blĕssings, pouring into the sterile regions of the nórth all the luxuries of the sòuth;* diffused the light of knowledge, and the charities of cultivated life; and has thus bound together those scattered portions of the human race, between which nature seems to have thrown an insurmountable barrier!

Exception 1.—Disconnected series :—

Youth, in the fulness of its spirits, defers religion to the sobriety of mànhood; manhood, encumbered with cares, defers it to the leisure of old àge; old age, weak and hesitating, is unable to enter on an untried mode of life.

Let me prepare for the approach of etèrnity; let me give up my soul to meditátion; let solitude and silence acquaint me with the mysteries of devòtion; let me forget the world, and by the world be forgotten, till the moment arrives in which the veil of eternity shall fall, and I shall be found at the bar of the Almighty.

Religion will grow up with you in yóuth, and grow old with you in àge; it will attend you, with peculiar pleasure, to the hovels of the póor, or the chamber of the sick; it will retire with you to your clòset, and watch by your béd, or walk with you, in gladsome union, to the house of Gòd; it will follow you beyond the confines of the wórld, and dwell with you for ever in hèaven, as its native residence.

Exception 2.—Emphatic series :—

Assemble in your parishes, villages, and hamlets. Resòlve, petition, addrèss.

This monument will speak of patriotism and coùrage; of civil and religious liberty; of free gòvernment; of the moral improvement and elevation of mankind; and of the immortal memory of those who, with heroic devotion, have sacrificed their lives for their country.

I have roamed through the world, to find hearts nowhere warmer than those of New E'ngland, soldiers nowhere bràver, patriots nowhere pùrer, wives and mothers nowhere trùer, maidens nowhere lòvelier, green valleys and bright rivers nowhere greener or brighter; and I will not be silent, when I hear her patriotism or her truth questioned with so much as a whisper of detraction.

What is the most odious species of tyranny? That a handful of men, free themselves, should execute the most base and abominable despotism over millions of their fellow-creatures; that innocence should be the victim of opprèssion; that industry should toil for ràpine; that the harmless labourer should sweat, not for his own benefit, but for the luxury and rapacity of tyrannic depredation;—in a wòrd, that thirty millions of men, gifted by Providence with the ordinary endowments of humanity, should groan under a system of despotism, unmatched in all the histories of the world.

Exception 3.—Poetio and pathetic series :—

He looks in boundless majesty abroad,
And sheds the shining day, that burnished plays
On rŏcks, and hills, and tŏwers, and wandering stréams,
High-gleaming from afàr.

Round thy beaming car,
High-seen, the Seasons lead, in sprightly dance
Harmonious knit, the rosy-fingered Hŏurs,
The Zephyrs floating loŏse, the timely Rains,
Of bloom ethereal, the light-footed Déws,
And, softened into joy, the surly Stòrms.

Hear him compare his happier lot, with *his*
Who bends his way across the wintry wŏlds,
A poor night-traveller, while the dismal snow
Beats in his făce, and dubious of his paths,
He stŏps and thinks, in every lengthening blast,
He hears some village mastiff's distant hŏwl,
And sees, far streaming, some lone cottage light;
Then, undeceived, upturns his streaming ĕyes,
And clasps his shivering hănds, or, overpowered,
Sinks on the frozen grŏund, weighed down with sleep,
From which the hapless wretch shall never wàke.

There was neither trĕe, nor shrŭb, nor fiĕld, nor hŏuse, nor living creatures, nor visible remnant of what human hands had rèared.

I am charged with pride and ambition. The charge is true, and I glory in its truth. Who ever achieved anything great in letters, art, or arms, who was not ambitious? Cæsar was not more ambitious than Cicero. It was but in another way. All greatness is born of ambition. Let the ambition be a noble one, and who shall blame it? I confess I did once aspire to be queen, not only of Palmyra, but of the East. That I am. I now aspire to remain so. Is it not an honourable ambition? Does it not become a descendant of the Ptolemies and of Cleopatra? I am applauded by you all for what I have already done. You would not it should have been less.

But why pause here? Is so much ambition praiseworthy, and more criminal? Is it fixed in nature that the limits of this empire should be Egypt on the one hand, the Hellespont and the Euxine on the other? Were not Suez and Armenia more natural limits? Or hath Empire no natural limit, but is broad as the genius that can devise, and the power that can win? Rome has the West. Let Palmyra possess the East. Not that nature subscribes this and no more. The gods prospering, and I swear not that the Mediterranean shall hem me in upon the west, or Persia on the east. Longinus is right: I would that the world were mine. I feel, within, the will and the power to bless it, were it so.

Are not my people happy? I look upon the past and the present, upon my nearer and remoter subjects, and ask nor fear the answer. Whom have I wronged?—what province have I oppressed?—what city pillaged?—what region drained with taxes?—whose life have I unjustly taken, or estates coveted or robbed?—whose honour have I wantonly assailed?—whose rights, though of the weakest and poorest, have I trenched upon? I dwell, where I would ever dwell, in the hearts of my people. It is written in your faces, that I reign not more *over* you than *within* you. The foundation of my throne is not more power than love.

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* Accidental "falling" inflection, for contrast.

How shall I know thee in the sphere which keeps
The disembodied spirits of the dead,
When all of thee that time could wither, sleeps,
And perishes among the dust we tread?

For I shall feel the sting of ceaseless pain,
If there I meet thy gentle presence not;
Nòr hear the voice I love, nor read again
In thy serenest eyes the tender thought.

Will not thy own meek heart demand me there?
That heart whose fondest throbs to me were given?
My name on earth was ever in thy prayer,
Shall it be banished from thy tongue in heaven?

In meadows fanned by heaven's life-breathing wind,
In the resplendence of that glorious sphere,
And larger movements of the unfettered mind,
Wilt thou forget the love that joined us here?

The love that lived through all the stormy past,
And meekly with my harsher nature bore,
And deeper grew, and tenderer to the last,
Shall it expire with life, and be no more?

A happier lot than mine, and larger light,
Await thee there; for thou hast bowed thy will
In cheerful homage to the rule of right,
And lovedst all, and renderedst good for ill.

For me, the sordid cares in which I dwell
Shrink and consume the heart, as heat the scroll;
And wrath has left its scar,—the fire of hell
Has left its frightful scar upon my soul.

Yet, though thou wear'st the glory of the sky,
Wilt thou not keep the same beloved name,
The same fair thoughtful brow, and gentle eye,
Lovelier in heaven's sweet climate, yet the same?

Shalt thou not teach me, in that calmer home,
The wisdom that I learned so ill in this,—
The wisdom which is love,—till I become
Thy fit companion in that land of bliss?

Both Inflections in Connection.

Rule 1.—Negation opposed to affirmation:—

It is not a parchment of pèdigree,—it is not a name derived from the ashes of dead men, that make the only charter of a king Englishmen were but slaves, if, in giving crown and sceptre to a mortal like ourselves, we ask not, in return, the kingly virtues.

The true enjoyments of a reasonable being do not consist in unbounded indùlgence,* or luxurious ease, in the tumult of passions, the languor of indolence, or the flutter of light amusements. Yielding to immóral pleasures corrupts the mind; living to animal and trifling ones, debases it; both, in their degree, disqualify it for genuine góod, and consign it over to wrètchedness.

What constitutes a state?
Not high-raised bǎttlements, or laboured móund,
Thick wǎll, or moated gáte;
Not cities proud, with spires and turrets crowned,
Not bǎys and broad-armed pórts,
Where, laughing at the storm, proud návies ride;
Not starred and spangled cóurts,—
Where low-browed baseness wafts perfume to pride!

No!—*mèn*,—high-minded MÈN,—
Men who their duties know,
But know their rights, and, knowing, dare maintàin.

Note.—Concession and unequal antithesis:—

The clouds of adversity may darken over the Christian's path; but he can look up with filial trust to the guardian care of a beneficent Fàther.

I admit that the Greeks excelled in acuteness and versatility of mind. But in the firm and manly traits of the Roman character, I see something more nòble, more worthy of admiràtion.

We war against the lèaders of evil—not against the helpless tóols: we war against our oppressors—not against our misguided brethren.

Still, still, for ever
Better, though each man's life-blood were a river
That it should flow, and overflow, than creep
Through thousand lazy channels in our veins,
Dammed, like the dull canal, with locks and cháins,
And moving, as a sick man in his sleep,
Three paces, and then faltering; better be
Where the extinguished Spàrtans still are free,
In their proud charnel of Thermòpylæ,
Than stagnant in our mársh.

Exception.—Emphatic negation:—

I'll keep them all;
He shall not have a Scot of them;
Nò, if a Scot would save his soul, he shall not

Do not descend to your graves with the disgraceful censure, that you suffered the liberties of your country to be taken away, and that you were mùtes as well as còwards. Come forward, like men; protest against this atrocious attempt.

I am not sounding the trumpet of war. There is no man who more sincerely deprecates its calamities than I do.

Rest assured that, in any case, we shall not be willing to rank last in this generous contest. You may depend on us for whatever heart or hand can dò, in so noble a cause.

I will cheerfully concede every reasonable demand, for the sake of peace. But I will not submit to dictation.

Rule 2.—Question and answer:—

Do you think these yells of hostility will be fórgotten? Do you suppose their echo will not reach the plains of my injured and insulted country, that they will not be whispered in her green valleys, and heard from her lofty hills? Oh! they *will* be heard there; yès, and they will nòt be forgotten.

I will say, what have any classes of you, in Ireland, to hope from the French? Is it your próperty you wish to preserve? —Look to the example of Holland, and see how that nation has preserved its property by an alliance with the French! Is it indepèndence you court?—Look to the example of unhappy Switzerland see to what a state of servile abasement that once manly territory has fallen, under France! Is it to the establishment of Catholicity that your hopes are directed? The conduct of the First Consul, in subverting the power and authority of the Pòpe, and cultivating the friendship of the Mussulman in Egypt, under a bòast of that subversion, proves the fallacy of such a reliance. Is it civil liberty you require? Look to France itself, crouching under despotism, and groaning beneath a system of slavery, unparalleled by whatever has disgraced or insulted any nation.

Shall I be left forgotten, in the dust,
When Fate, relenting, lets the flower revive?
Shall Nature's voice,—to man alone unjust,—
Bid him, though doomed to perish, hope to live?

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* The penultimate inflection falls, when a sentence ends with the rising slide.

Is it for this fair Virtue oft must strive
  With disappointment, penury, and pain?
Nò: Heaven's immortal spring shall yet arrive,
  And man's majestic beauty bloom again,
Bright through the eternal year of Love's triumphant rèign.

Rule 3.—Disjunctive *or*:—

Will you rise like men, and firmly assert your rights, or will you tamely submit to be trampled on?

Did the Romans, in their boasted introduction of civilisation, act from a principle of humane interest in the welfare of the wórld? Or did they not rather proceed on the greedy and selfish policy of aggrandising their own nátion, and extending its dominion?

Do virtuous hábits, a high standard of morálity, proficiency in the arts and embellishments of life, depend upon physical formátion, or the latitude in which we are placed? Do they not depend upon the civil and religious institutions which distinguish the country?

The remaining rules on inflection, as they are of less frequent application, are thought to be sufficiently illustrated by the examples appended to each rule. A repetition of these, however, may be useful to the student as an exercise in review.

BOTANY.—XXII.

[*Continued from p.* 53.]

CRYPTOGAMIA—PTERIDOPHYTA.

THERE are few hard and fast lines in nature; so, as we learn more about the fossil plants of the Coal-Measures, we find that the boundary between the gymnosperms, the lower division of flowering plants, and the higher groups of the so-called flowerless plants is less definite than at first appears. The *Cryptogamia*, as we have seen (Vol. IV., pp. 354–5), were so called because their reproductive organs are often hidden from observation by their small size, and have, therefore, long remained undescribed and unexplained; but they are perhaps more distinguished from phanerogams by the absence of structures strictly homologous to seeds than by the absence of anything that might be called a flower. Their vegetative organs are on the whole simpler than those of flowering plants or, as phanerogams have been termed, *spermaphytes* (seed-plants); and the *macrospore* (embryo-sac) even in the highest types is distinct from the *macrosporangium*, the latter not including it with its prothallium and archegonia or embryos, as in gymnosperms. The *antheridium* (pollen-tube) in most cryptogams produces a minute, definitely formed, protoplasmic body, the sperm-cell, which is commonly furnished with thread-like cilia by which it swims about in water, and which is, therefore, known as the *antherozoid* (from Greek *ζῶον, zōon*, an animal). This closely resembles the spermatozoa of animals. One of the most obvious characteristics of most cryptogams is the formation and liberation of quantities of simple reproductive structures known generally as *spores*, so that they have been called spore-producing plants, but there is no essential difference between a pollen-grain and one of the spores of cryptogams, so this distinction will not hold good.

As we have seen (Vol. IV., p. 355) the cryptogams comprise several very distinct types of structure, three at least of which are of sufficient structural importance to rank with Phanerogamia as subkingdoms. They are now well known as *Pteridophyta*, *Bryophyta*, and *Thallophyta*. Of these, the first two mostly agree with phanerogams in having a well marked distinction between a stem or ascending axis and true leaves or lateral appendages to the stem, and they have, therefore, been classed with phanerogams under the name *Cormophyta*. They also agree with gymnosperms in the production of archegonia within which are the germ-cells or oospheres, and *Gymnospermia*, *Pteridophyta*, and *Bryophyta* are, therefore, sometimes called *Archegoniatæ*.

Pteridophyta and *Bryophyta* agree further in exhibiting a marked *alternation of generations*, as it is called, the spore in germinating giving rise to a plant very dissimilar to that which bore it. The two generations or stages are known as the *sporophore* or *sporophyte*, and the *oophore* or *oophyte*, the former being asexual, bearing spores without any sexual process, whilst the latter is sexual, bearing the antheridia and the archegonia from the fertilisation of which arises another sporophore. The two subkingdoms are contrasted in that, whilst in Pteridophyta the sporophore is the conspicuous leafy plant and the oophore small and transitory, in Bryophyta the leafy plant is the oophore and the sporophore a mere appendage to it.

The *Pteridophyta* (Greek πτερὶς, *ptĕris*, a fern; φυτὸν, *phutŏn*, a plant) or, as they are often called, Vascular Cryptogams, include ferns, club-mosses, and horse-tails, with a few other allied types. In all these groups the spores in germinating give rise to small delicate prothallia (the oophore) bearing the archegonia and antheridia either separately or together (Fig. 91, D). Each archegonium originates, as in gymnosperms, from one surface cell of the prothallium which divides until it produces a pouch-like body or *venter* surrounding the central cell or oosphere, a short *neck* usually of four tiers of four cells each, and two axile canal-cells which become mucilaginous (Fig. 91, F). The antheridia (Fig. 91, E) are usually roundish and give rise in their interior to numerous *spermatocytes* or mother-cells of the antherozoids. These spermatocytes are simple cells, each containing a few starch-granules and an antherozoid, the latter formed mainly from its nucleus. The antherozoids are spirally coiled threads thickened at one end and bearing numerous cilia near the other extremity. These bodies burst their mother-cells as they leave the antheridium and swim through the water until they find their way down the neck of the archegonium, through the mucilaginous canal-cells, to the oosphere, with which they coalesce.

The *oospore* or fertilised oosphere in most cases becomes itself the embryo, without the formation of any suspensor as in phanerogams; but in this respect one group of club-mosses, the Selaginellas, resembles flowering plants. The embryo divides into four parts, a primary root or radicle, which does not, however, reach any size, one or two primary leaves or cotyledons, a primary stem-shoot or plumule, and a structure called the *foot* which remains imbedded in the prothallium and draws the first nourishment for the young sporophore from it.

The sporophore is the conspicuous plant with stem and leaves which generally gives off rootlets and lives for many years. As the oophore is always small and in some cases is not even known, it is upon the characters of the asexual generation or sporophore that the classification of pteridophytes mainly depends. The stem is sometimes unbranched, or it is dichotomous or monopodial, and it may have branches in whorls, much as in gymnosperms; but the branches seem never to arise, as they always do in phanerogams, from axillary buds. Histologically the stem exhibits

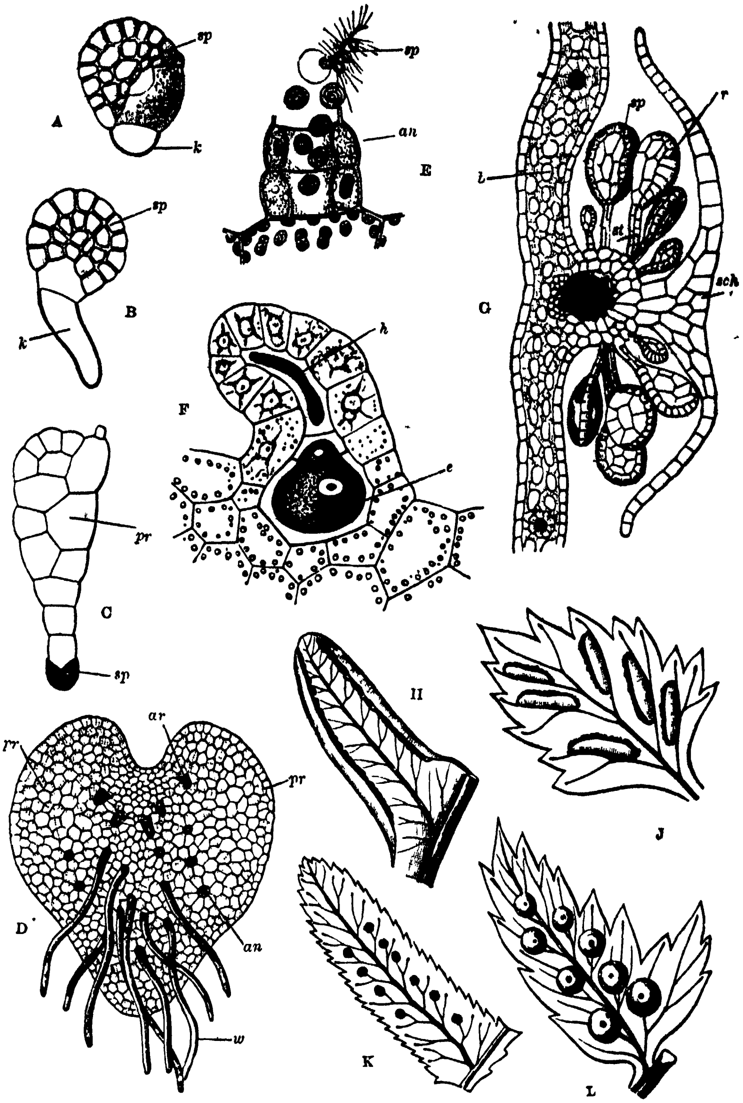

Fig. 91.—LIFE-HISTORY OF FERNS.

A, Germinating spore of *Polypodium vulgare*: *sp*, exospore; *k*, first root-hair. B, The same later. C, Young prothallus of *Aspidium*: *sp*, spore; *pr*, prothallus. D, Under-surface of the same later: *pr*, prothallus; *w*, root-hairs; *an*, antheridia; *ar*, archegonia. E, Antheridium of Bracken (*Pteris*), bursting: *sp*, antherozoid escaping from spermatocyte. F, Archegonium of the same, unopen: *h*, mucilaginous canal-cell; *e*, central cell. G, Section through a pinnule of the frond and sorus of *Aspidium*: *b*, mesophyll; *sch*, indusium; *sp*, sporangium; *st*, its stalk; *r*, annulus. H, Pinnule of *Pteris*, showing veins and sori. J, The same in *Asplenium*. K, The same in *Polypodium* (sori naked). L, The same in *Aspidium*.

a distinct epidermis, a collenchymatous or sclerenchymatous hypoderm, copious fundamental tissue, and one, several, or many bundles of fascicular tissue. These bundles are closed, their phloem usually surrounding the xylem. True vessels seldom occur.

The leaves may be small and simple, but in many ferns reach as large a size and as complicated a system of branching as in the Umbelliferæ or any other group of phanerogams. They have stomata, often on both surfaces; but their venation is simple, consisting either of a single midrib or of a system of repeatedly bifurcating (*furcate*) veins which do not unite into a network (Fig. 91, H, J, K, L).

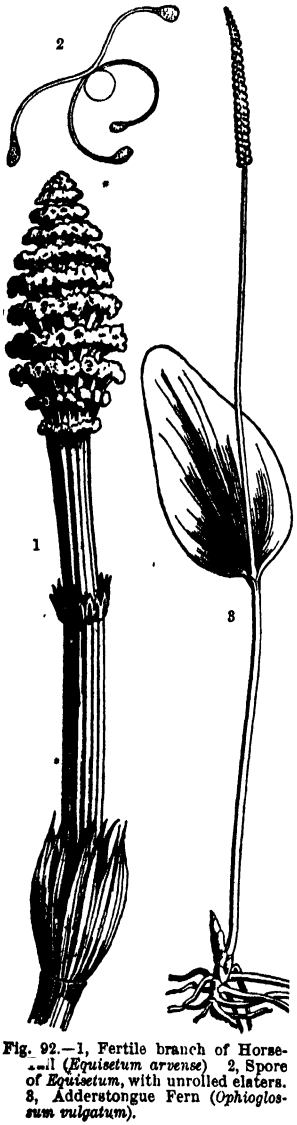

Fig. 92.—1, Fertile branch of Horse-tail (*Equisetum arvense*) 2, Spore of *Equisetum*, with unrolled elaters. 8, Adderstongue Fern (*Ophioglossum vulgatum*).

In some cases all the leaves are sporophylls; in others there are some so-called *barren* leaves or ordinary foliage leaves, and others which are *fertile* or bear *sporangia* or spore-cases; but there is generally no such marked contrast between these two types as there is in angiosperms. Sometimes, however, the sporangia, like ovules and stamens in exceptional phanerogams, are of cauline and not of foliar origin.

The sporangium sometimes originates from a single cell (*leptosporangiate*) as in most ferns and rhizocarps, or in other cases from a group of cells (*eusporangiate*), as in horse-tails and club-mosses. It consists generally of an outer *wall* of one or more layers of cells, a *tapetum* or lining of delicate cells which are afterwards absorbed, and an inner mass of *sporogenous* (spore-producing) tissue, the *sporocytes* or mother-cells of the spores. Each of these mother-cells divides into four.

In ferns, horse-tails, and lycopods only one kind of spore is produced, though, when the spore in these groups has germinated and given rise to a prothallium, that prothallium may bear archegonia or antheridia exclusively, being thus male or female, so that the oophore becomes diœcious. These groups are, therefore, combined in the division *Isosporia* (Greek ἴσος, *isŏs*, equal). In rhizocarps and selaginellas, on the other hand, two kinds of sporangia are produced, *macrosporangia* or *megasporangia* (Greek μακρὸς, *macrŏs*, long; μέγας, *mĕgas*, great) producing female macrospores or megaspores, and *microsporangia* (Greek μικρὸς, *micrŏs*, small) producing male microspores. These macrospores correspond to the embryo-sacs and the macrosporangia to the tercines of phanerogams; whilst the microspores are homologous to pollen-grains and the microsporangia to pollen-sacs. The groups in which the distinction between the sexes is thus carried back into the sporophore stage form the division *Heterosporia* (Greek ἕτερος, *hĕtĕros*, different). This division includes the two classes *Rhizocarpeæ* and *Ligulatæ*. Their macrosporangia contain a small number of macrospores and their microsporangia a larger number of microspores. Both kinds of spores produce relatively small prothallia which remain attached to the spore and cannot be said to lead an independent existence, so that the oophore stage is merely an appendage to the asexually-produced bodies detached from the sporophore.

The *Rhizocarpeæ*, or *Hydropteridæ*, as they have been called, include two orders, each with two small genera, of aquatic or semi-aquatic plants. In England they are represented only by the little pill-wort (*Pilularia globulifera*). The oophore, or sexual generation, in this group is developed from two kinds of spores, microspores and macrospores. The microspores are male, corresponding to the pollen-grains of phanerogams. They divide into three cells, one representing the prothallium (the "included cells" of gymnosperms), and the other two the antheridium (pollen-tube). The protoplasm of these two cells divides repeatedly so as to form four or sixteen spermatocytes, in each of which is formed a spirally coiled and ciliated antherozoid and a few starch-grains. The spermatocytes burst and liberate the antherozoids as they themselves escape from the antheridia. The macrospores, which are female, are several hundred times larger than the microspores. They have generally a roundish papilla at their apex in which a small prothallium (archisperm) is developed, bearing from one to three archegonia. The interior of the spore is filled with starch (metasperm). The archegonia resemble those of gymnosperms, having a rosette of four neck-cells with one neck canal-cell and a large central cell, the upper part of which forms a ventral canal cell, the lower part the oosphere. On fertilisation by the antherozoids the oospore in the floating macrospore divides horizontally, and then by vertical transverse and median walls, into eight, the upper four cells giving rise to the rudiment of the stem and one or two cotyledons, and the lower four to the foot and root.

The four genera differ very much in the general "habit" or external appearance of their sporophore stage. *Pilularia* has a creeping stem giving off roots below and leaves, which are reduced to circinate petioles, above. At the bases of these leaves are the pill-like *sporocarps* or spore-fruits, from which it takes its name. The sporocarp probably represents a segment of a leaf with four lobes as it is four-chambered. It contains macrosporangia below, each enclosing one macrospore, and microsporangia, each containing sixty-four microspores, above. *Marsilia*, including the Nardoo of tropical Australia, upon the sporocarps of which the ill-fated Burke and Wills expedition lived for a time, has bifurcating leaves, one segment of which is sterile, ending in four delicate green leaflets, whilst the other bears a bean-shaped sporocarp. These genera form the order *Marsiliaceæ*. *Salvinia* is a floating, rootless plant with leaves in whorls of three. Two leaves are entire, and float owing to the large air-spaces in their mesophyll, whilst the third is cut into hair-like submerged segments, and bears the small round sporocarps near its base. These sporocarps are in fact leaf-segments, each of which first develops as a *placenta*, from which spring numerous sporangia, whilst a circular outgrowth or *indusium* springs from the base of the placenta, and growing up round the sporangia, forms the wall of the capsular sporocarp. Some sporocarps contain microsporangia; others, macrosporangia. *Azolla*, the other genus of the *Salviniaceæ*, is a minute floating plant furnished with roots.

The *Ligulatæ*, the second class among the Heterosporia, comprise the two orders *Selaginellaceæ* and *Isoëtaceæ*. These orders agree in many points in their sexual stage, but differ much in the form of the sporophore. They differ from the *Rhizocarpeæ* in having the female prothallium more enclosed within the macrospore, and in the *ligule* which springs from above the base of each leaf. The sporangia are sunk in the bases of the fertile leaves below this ligule, and are often covered by a membranous outgrowth or *indusium*. *Selaginella* is a genus of club-mosses with trailing stems and small simple adpressed leaves. The stem has a distinct epidermis, a thickened hypoderm, and a few vascular bundles, but no stomata. Its elements are mostly prosenchymatous, and the bundles, which are concentric, consist of scalariform tracheides and thin-walled phloem, and are surrounded by large air-spaces crossed by strands of cells. The stem branches racemosely in one plane (dorsiventrally), but the branches do not arise in the axils of leaves. The leaves are acute, or end in an awn, and the sterile ones are in four orthostichies and generally of two sizes, the *ventral* leaves, those on the shaded side, being larger than the *dorsal* ones. Stomata occur mostly on their lower surfaces. The fertile leaves (sporophylls) form a four-sided cone, some bearing macrosporangia, others microsporangia, these bodies really originating from the stem above the origin of the leaf. The root springs from special leafless branches termed *rhizophores*. The sporangia resemble one another in development and appearance; but, whilst the microsporangia produce numerous microspores, the macrosporangia only contain four macrospores. The development of these spores much resembles that in the Rhizocarpeæ. The macrospore produces a prothallium (archisperm) bearing archegonia, and subsequently the cavity

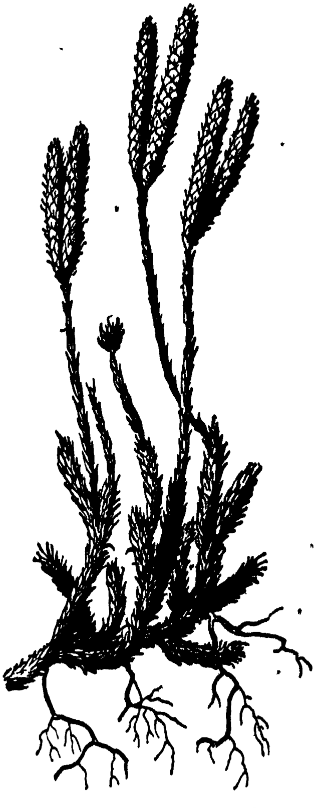

Fig. 93.—Club-moss (*Lycopodium clavatum*).

of the spore becomes filled by a large-celled tissue (metasperm). *Selaginella*, alone among cryptogams, produces a suspensor of one or more cells, formed from the upper half of the oospore. Occasionally the sexual generation is suppressed, a new sporophore springing directly from the base of a leaf. This is termed *apogamy*.

Isoëtes, the quill-worts, submerged plants growing in Welsh and other lakes, have a short corm-like perennial stem only containing the united ends of the vascular bundles of the leaves. The leaves are in annual rosettes, are from two to thirty inches long, and have a broad sheath and a thick, almost cylindric, lamina, traversed by four air-canals.

The *Isosporia* are characterised, not only by the sexual differentiation not being carried so far back, so that they only produce one kind of spore, and sometimes only a monœcious prothallium, but also by the prothallium (oophore) being a larger and more independent structure than in higher groups. The division includes the three classes *Lycopodinæ*, *Equisetinæ*, and *Filicinæ*.

The *Lycopodinæ* are club-mosses, closely resembling *Selaginella* in their vegetative structure. Their stems are sometimes erect, sometimes prostrate, and branch either racemosely or dichotomously, their roots arise directly from the stem, and their small simple leaves are either spirally arranged or variously whorled. The leaves generally have stomata on both surfaces and one simple vascular bundle united to the xylem of the stem. The stem has a defined epidermis and often a thick-walled cortex, sclerenchymatous inner fundamental tissue, a bundle-sheath of from one to three layers of cells, and a characteristic axile vascular cylinder resembling that in the roots of flowering plants. It consists of several bands of xylem, made up of spiral, pitted, and scalariform tracheides, and surrounded by phloem. The sporangia are formed on short stalks, one at the base of each leaf in the cone-like "fructification." The numerous minute yellow spores produced by them constitute the inflammable powder "Lycopodium" used to cover pills and to produce theatrical lightning. The prothallia have seldom been found. They are relatively large, and lead an independent life, though with little chlorophyll; and they each bear both antheridia and archegonia. Several species of *Lycopodium* are natives of our upland moors. (*See* Fig. 93, and Coloured Plate, "Types of Plant Life," Vol. III., Fig. 10.)

The *Equisetinæ* include only the one living genus *Equisetum*, the horse-tails, a small group of herbaceous plants found in wet places in most parts of the globe. The sporophore consists of a solid, creeping, colourless rhizome, often producing tubers, which sends up annual branches. Both stem and branches are distinctly ***articulated*** or jointed at the nodes, but the internodes of the branches are hollow (fistular). The rhizome is often covered with a felt of root-hairs. Some species send up short, brown, unbranched fertile branches in the spring; others bear their "fructifications" at the summit of branched green branches. (*See* Coloured Plate, "Types of Plant Life," Vol. III., Fig. 9). Each internode terminates above in a tubular sheath forming a whorl of rudimentary leaves, and its surface is ridged, each ridge ending in a leaf. The leaves of one internode rest in the hollows between the ridges in the next. Internally each leaf and ridge has a vascular bundle which divides at the node so as to unite with the two, one on either side of it, in the next internode. Besides the central or pith cavity there is generally an air-passage in the middle of each bundle, and one in the cortical tissue in each hollow between the ridges. The strength of the stem is mainly dependent upon the dermal and hypodermal tissue, which is so highly charged with silica that one species, *Equisetum hyemale*, is used, under the name of Dutch rushes, for polishing metal. The green branches and leaves have numerous stomata. The secondary branches spring in a whorl from between the leaves, and have a structure similar to that of the primary branches. The fertile branches (Fig. 92, 1) terminate in a club-shaped mass of sporophylls, arranged in whorls touching one another, much as are the stamens in the yew and some other gymnosperms. These sporophylls are modified leaves, and each of them is peltate, and usually six-sided, having a short stalk, and producing from five to ten sporangia round its margin. These sporangia split longitudinally, so liberating the spores. The spore is peculiar in containing chlorophyll and in having three coats, the outermost colourless, the next light blue, and the inmost one yellowish. The outermost and first-formed coat splits spirally into two bands, known as *elaters*, forming a four-armed cross attached by its centre to the second coat. If moistened, the elaters coil up; if dried, they unroll, their apparent function being to keep several spores together so that they may germinate side by side. The spore in germinating divides, puts out a long unicellular *rhizoid* or root-hair, and then forms a prothallium, which is at first ribbon-like and only one cell thick, but is afterwards irregularly lobed. They are generally diœcious, the female ones being the larger, sometimes reaching half an inch in length. The antheridia are papillæ one cell thick, on the lobes of the prothallium, the central cell in each dividing into a hundred or a hundred and fifty spermatocytes, each containing starch-grains and a comparatively large antherozoid. The archegonia are on the upper surface of the prothallium, and each has a distinct body or venter, one cell thick, round the central cell, and a neck, generally of four tiers of four cells each, with a canal-cell which becomes mucilaginous. The oospore forms the embryo directly, dividing into eight parts, of which the four lower ones give rise to the root and foot, and of the four upper ones, one is the plumule with a large three-sided pyramidal apical cell, two form one cotyledon, and the fourth another, these cotyledons uniting with the first leaf of the plumule into one annular leaf-sheath.

Though several species of *Lycopodium*, *Selaginella*, and *Equisetum* are commonly cultivated as ornamental plants, by far the best known of the Pteridophyta are the ferns or *Filicinæ*. Ferns are a large and natural group of plants of world-wide distribution and great geological antiquity; but especially characteristic of moist, insular and tropical climates, reaching in these latter the dimensions of large trees. The stems of the herbaceous kinds are rhizomes and often bifurcate; but those of the arborescent kinds are unbranched, increase slowly in size, and are crowned with tufts of leaves. This cylindrical unbranched form of stem, resembling that of a palm, is termed a *caudex*. Internally the stem has a circle of closed fibro-vascular bundles, from which branches are given off to the leaves, large strands of dense brown sclerenchyma in the fundamental tissue, and a sclerenchymatous hypoderm. The bundle is closed and concentric, consisting of scalariform tracheides, or true vessels, surrounded by phloem, which contains sieve-tubes, bast-fibres, and parenchyma. The stems of tree-ferns are often densely covered with aërial roots which may branch acropetally. Nothing is more characteristic of the sporophore stage of this group than the well developed leaves or *fronds*. These may be simple, as in the hartstongue (*Scolopendrium*), or dichotomous, as in the elkshorn (*Platycerium*), but are more often pinnately divided, and may reach a length of ten or twenty feet. They are generally circinate in vernation and furcate in venation, possess stomata, and have chlorophyll in their epidermal cells, but have no palisade-tissue. The leaf-stalks are often covered by dry brown membranous epidermal scales, known as *paleæ* or *ramenta*. The leaves grow at their apex and have a large apical cell, as have also the stem and the root, that of the latter, however, being covered by a root-cap. The so-called "fructification" is produced upon the leaves, usually on their under surface; but some ferns, such as the hard fern (*Lomaria Spicant*), the parsley fern (*Allosurus crispus*), and the elkshorn fern (*Platycerium*) have both barren and fertile fronds; whilst in others, such as the so-called flowering fern (*Osmunda regalis*), the fructification is confined to the upper lobes of the frond; and in the adderstongue (*Ophioglossum*, Fig. 92), and moonwort (*Botrychium*), the frond bifurcates into a barren and a fertile half. In these special fertile or sporangiferous structures the green parenchyma of the leaf is more or less suppressed. The sporangia are usually formed on the veins of the leaf which sometimes run out into a cushion known as the *receptacle* or *placenta*, as in *Salvinia* (Fig. 91, G). As in the rhizocarps also, the sporangia are usually collected together in groups, each known as a *sorus*, and each sorus is often covered by a cellular outgrowth from the leaf-or *indusium* (Fig. 91, H, J, L). In the filmy ferns (*Hymenophyllum*) the sporangia are on the veins which project beyond the margins of the leaves and the indusium is a cup-shaped outgrowth from the margin. The sporangia are usually *trichomic*, formed, that is, from a single epidermal cell; but in the adderstongues and the tropical *Marattiaceæ* they originate from a group of cells. Each sporangium is a small roundish or lenticular capsule, the wall of which is a single layer of cells, one row or group of which, termed the *annulus* (Fig. 91, G), have commonly thickened walls which, by contracting when dry, rupture the sporangium and liberate the spores. The spores have two coats, an *exospore* and an *endospore*, thus closely resembling the pollen-grains of angiosperms.

The prothallia of ferns (Fig. 91, C, D) are usually heart-shaped, develop numerous rhizoids, contain chlorophyll, are monœcious and, though short-lived, lead an entirely independent existence; but in some cases they are diœcious, and in others perennial. The antheridia (Fig. 91, E) and archegonia (Fig. 91, F) resemble those of *Equisetum*, but the latter are turned downwards toward the ground. The oospore divides into four parts, the two upper giving rise to the stem and the foot, and the two lower to the cotyledon and primary root. Some cultivated ferns do not exhibit this alternation of generations, being either *apogamous* or *aposporous*. *Apogamy* consists in the direct development of a new plant (sporophore) from the prothallium by vegetative growth, without the formation of an archegonium or any process of fertilisation. *Apospory* conversely consists in the development of prothallia in place of sporangia on the fronds. Many ferns also produce buds, like the bulbils of the tiger-lily, on their leaves; by which the plant is freely reproduced. Few ferns have any economic uses, but the group is one of the greatest favourites of the cultivator from the beauty of its foliage.

GERMAN.—XXXII.

[*Continued from p. 49.*]

DECLENSION OF ADJECTIVES.

Whether an adjective is to be inflected at all, or not, depends wholly upon the way in which it is used; for, when employed as a predicate, it is never declined; when as an attribute, almost always. Be the noun, therefore, masculine, feminine, or neuter; be it singular or plural—if the adjective to which it is applied be used as a predicate, its form remains unchanged: thus—

Der Mann iſt gut, the man is good.
Die Frau iſt gut, the woman is good.
Das Kind iſt gut, the child is good.
Die Männer ſind gut, the men are good.
Ich nenne die Kinder ſchön, I call the children beautiful.

DECLINABLE ADJECTIVES.

There are two declensions of adjectives, as there are two declensions of nouns—the Old and the New. In either of these, according to circumstances, are attributive adjectives declined. The following are the terminations of

THE OLD DECLENSION.

	Singular.			*Plural.*
	MASC.	FEM.	NEUT.	FOR ALL GENDERS.
Nom.	-er	-e	-es.	-e.
Gen.	-es, en	-er	-es, en.	-er.
Dat.	-em	-er	-em.	-en.
Acc.	-en	-e	-es.	-e.

Adjectives ending in -el, -en, -er, commonly drop the e upon receiving a suffix, as:—

Edel, noble.	Edler Mann, noble man.
Eben, even.	Ebner Weg, even path.
Lauter, pure.	Lautres Geld, pure gold.

Upon adding -en, the e of the termination (-en) may be dropped, as:—Den heitern, or heitren Morgen, the serene morning.

In the genitive singular masculine and neuter the termination -en is preferable.

RULE FOR ADJECTIVES.

When the adjective stands either entirely alone before its substantive, or is preceded and restricted by a word that is undeclined or indeclinable, it follows the Old form of declension.

EXAMPLES.

	Singular.	*Plural.*
	MASCULINE.	
N.	Guter Vater, good father.	Gute Väter, good fathers.
G.	Gutes(en) Vaters, of good father.	Guter Väter, of good fathers.
D.	Gutem Vater, to good father.	Guten Vätern, to good fathers.
A.	Guten Vater, good father.	Gute Väter, good fathers.
	FEMININE.	
N.	Gute Mutter, good mother.	Gute Mütter, good mothers.
G.	Guter Mutter, of good mother.	Guter Mütter, of good mothers.
D.	Guter Mutter, to good mother.	Guten Müttern, to good mothers.
A.	Gute Mutter, good mother.	Gute Mütter, good mothers.
	NEUTER.	
N.	Gutes Geld, good money.	Gute Gelder, good moneys.
G.	Gutes(en) Geldes, of good money.	Guter Gelder, of good moneys.
D.	Gutem Gelde, to good money.	Guten Geldern, to good moneys.
A.	Gutes Geld, good money.	Gute Gelder, good moneys.

THE NEW DECLENSION.

	Singular.			*Plural.*
	MASC.	FEM.	NEUT.	FOR ALL GENDERS.
Nom.	-e	-e	-e.	-en.
Gen.	-en	-en	-en.	-en.
Dat.	-en	-en	-en.	-en.
Acc.	-en	-e	-e.	-en.

RULE FOR ADJECTIVES.

When immediately preceded and restricted by the definite article, by a relative or demonstrative pronoun, or by an indefinite numeral declined after the ancient form, the adjective follows the New form of declension.

EXAMPLES.

Singular.

	MASCULINE.	FEMININE
N.	Der gute Mann, the good man.	Die gute Frau, the good woman.
G.	Des guten Mannes, of the good man.	Der guten Frau, of the good woman.
D.	Dem guten Manne, to the good man.	Der guten Frau, to the good woman.
A.	Den guten Mann, the good man.	Die gute Frau, the good woman.

NEUTER.

Nom.	Das gute Kind, the good child.
Gen.	Des guten Kindes, of the good child.
Dat.	Dem guten Kinde, to the good child.
Acc.	Das gute Kind, the good child.

Plural.

	MASCULINE.	FEMININE
N.	Die guten Männer, the good men.	Die guten Frauen, the good women.
G.	Der guten Männer, of the good men.	Der guten Frauen, of the good women.
D.	Den guten Männern, to the good men.	Den guten Frauen, to the good women.
A.	Die guten Männer, the good men.	Die guten Frauen, the good women.

	NEUTER.
Nom.	Die guten Kinder, the good children.
Gen.	Der guten Kinder, of the good children.
Dat.	Den guten Kindern, to the good children.
Acc.	Die guten Kinder, the good children.

The words referred to in the rules are—

- Der, the.
- Dieſer, this.
- Jener, that.
- Welcher, who, which.
- Solcher, such.
- Jeder, jeglicher, each.
- Aller, every, all.
- Einiger, some, several.
- Etlicher, some, several.
- Mancher, many a.

When welcher, ſolcher, and mancher appear without the terminations of declension, the adjective assumes the suffixes denoting gender, etc. Thus: manch ſchönes Bild, many a beautiful picture.

With many authors it is the custom to reject the final n of the nominative and accusative plural of adjectives preceded by einige, etliche, mehrere, manche, viele, alle, welche, ſolche, and wenige; as:—Einige deutſche Kaiſer, some German emperors.

MIXED DECLENSION.

After the words—

- Ein, a, an.
- Kein, no, none.
- Mein, my, mine.
- Dein, thy, thine.
- Sein, his, its.
- Ihr, her, your, their.
- Unſer, our.
- Euer, your.

an adjective assumes in the nominative singular of the masculine, feminine, and neuter, and in the accusative singular of the feminine and neuter, the terminations proper to the old form.

TERMINATIONS OF THE MIXED DECLENSION.

	Singular.			*Plural.*
	MASC.	FEM.	NEUT.	FOR ALL GENDERS.
Nom.	-er (old form)	-e	-es (old form).	-en.
Gen.	-en	-en	-en.	-en
Dat.	-en	-en	-en.	-en.
Acc.	-en	-e	-es (old form).	-en.

It must be added, also, that the personal pronouns (ich, I; du, thou; er, he; ſie, she; es, it; wir, we; ihr, ye *or* you; ſie, they) cause the adjective before which they stand generally to take this mixed form of declension.

RULE FOR ADJECTIVES.

When the adjective is immediately preceded and restricted by the indefinite article, by a personal or possessive pronoun, or by the word kein, it assumes the endings characteristic of the Mixed declension.

EXAMPLES.

Singular.

	MASCULINE.	FEMININE.
N.	Ein guter Bruder, a good brother.	Meine gute Schweſter, my good sister.
G.	Eines guten Bruders, of a good brother.	Meiner guten Schweſter, of my good sister.
D.	Einem guten Bruder, to a good brother.	Meiner guten Schweſter, to my good sister.
A.	Einen guten Bruder, a good brother.	Meine gute Schweſter, my good sister.

	NEUTER.
Nom.	Unſer gutes Haus, our good house.
Gen.	Unſers guten Hauſes, of our good house.
Dat.	Unſerm guten Hauſe, to our good house.
Acc.	Unſer gutes Haus, our good house.

Plural.

	FEMININE.	NEUTER.
N.	Meine guten Schweſtern, my good sisters.	Unſre guten Häuſer, our good houses.
G.	Meiner guten Schweſtern, of my good sisters.	Unſrer guten Häuſer, of our good houses.
D.	Meinen guten Schweſtern, to my good sisters.	Unſern guten Häuſern, to our good houses.
A.	Meine guten Schweſtern, my good sisters.	Unſre guten Häuſer, our good houses.

FURTHER OBSERVATIONS ON ADJECTIVES.

When several consecutive adjectives come before and qualify the same noun, each has the same form which, according to the preceding rules, it would have if standing alone, as:—Guter, rother, lautrer Wein, good, red, pure wine; Die reife, ſchöne, gute Frucht, the ripe, beautiful, good fruit.

But when of two adjectives which relate to the same noun the second forms with the noun an expression for a single idea, which the first qualifies as a whole, the second adjective takes (except in the nominative singular and in the nominative and accusative plural) the new form of declension, as:—Mit trocknem weißen Sand, with dry white sand; where *white sand*—that is, sand which is white—is said also to be *dry*.

Participles are declined after the manner of adjectives; thus, der geliebte Bruder, the beloved brother; genitive, des geliebten Bruders, of the beloved brother, etc.

Adjectives in German, as in other languages, are, by an ellipsis, often made to serve in place of nouns. They then begin with a capital letter, and, excepting that they retain the forms of declension peculiar to adjectives, are in all respects treated as nouns. Their gender is made apparent either by their terminations or by the presence of an article or other definitive word, as:—Ein Deutſcher, a German; dieſer Deutſche, this German; die Deutſche, the German woman; das Schöne, the beautiful; das Gute, the good (that is, that which is beautiful; that which is good). So, also: das Weiß, the white; das Grün, the green; das Roth, the red, etc.

COMPARISON OF ADJECTIVES.

In German, as in English, the degrees of comparison are commonly expressed by means of the suffixes -er and -eſt; thus :—

Positive.	*Comparative.*	*Superlative.*
Wild, wild ;	wilder, wilder ;	wildeſt, wildest.
Feſt, firm ;	feſter, firmer ;	feſteſt, firmest.

EUPHONIC CHANGES.

When the positive does not end in -d, -t, -ſt, -s, -ß, -ſch, or -z, the e of the superlative suffix (-eſt) is omitted, as .—

Klar, clear ;	klarer, clearer ;	klarſt, clearest.
Rein, pure ;	reiner, purer ;	reinſt, purest.
Schön, fine ;	ſchöner, finer ;	ſchönſt, finest.

When the positive ends in -e, the e of the comparative and superlative suffixes (-er, -eſt) is dropped, as :—

Weiſe, wise ;	weiſer, wiser ;	weiſeſt, wisest.
Müde, weary ;	müder, more weary ;	müdeſt, most weary.

When the positive ends in -el, -en, or -er, there would be two e's close together ; in the comparative the first is omitted ; in the superlative, the second ; as :—

Edel, noble ;	edler, nobler ;	edelſt, noblest.
Trocken, dry ;	trockner, drier ;	trockenſt, driest.
Tapfer, brave ;	tapfrer, braver ;	tapferſt, bravest.

When the positive is a monosyllable, the radical vowel (if it be capable of it) commonly takes the Umlaut in the comparative and superlative, as .—

Alt, old ;	älter, older ;	älteſt, oldest.
Grob, coarse ;	gröber, coarser ;	gröbſt, coarsest.
Klug, wise ;	klüger, wiser ;	klügſt, wisest.

Exceptions.—From this last rule, however, must be excepted all those adjectives containing the diphthong -au, as :—Laut (loud), lauter, lauteſt, rauh (rough), rauher, rauheſt. So, also, the following :—

Bunt, variegated.	Knapp, tight.	Satt, satisfied.
Fade, flat.	Lahm, lame.	Schlaff, loose.
Fahl, pale.	Laß, weary.	Schlank, slender.
Falb, fallow.	Los, loose.	Schroff, rugged.
Flach, flat.	Matt, tired.	Starr, stiff.
Froh, glad.	Nackt, naked.	Stolz, proud.
Gerade, straight.	Platt, flat.	Straff, stiff, tight.
Glatt, smooth.	Plump, clumsy.	Stumm, dumb
Hohl, hollow.	Roh, raw.	Stumpf, blunt.
Hold, amiable.	Rund, round.	Toll, mad.
Kahl, bald.	Sacht, slow.	Voll, full.
Karg, stingy.	Sanft, gentle.	Zahm, tame.

DECLENSION OF COMPARATIVES AND SUPERLATIVES.

Comparatives and superlatives are subject to the same laws of declension that regulate adjectives in the positive. Thus, after adding to ſchön (fair) the suffix (-er), we get the comparative form ſchöner (fairer), which is inflected in the three following ways :—

EXAMPLES OF THE COMPARATIVE.

(*a*) OLD FORM.

	Singular.			*Plural.*
	MASC.	FEM.	NEUT.	FOR ALL GENDERS.
N.	Schönerer	-e	-es.	Schönere, fairer.
G.	Schöneres (en)	-er	-es (en).	Schönerer, of fairer.
D.	Schönerem	-er	-em.	Schöneren, to fairer.
A.	Schöneren	-e	-es.	Schönere, fairer.

(*b*) NEW FORM.

	MASC.	FEM.	NEUT.	FOR ALL GENDERS
N.	Der ſchönere	(die) -e	(das) -e.	Die ſchöneren, the fairer.
G.	Des ſchöneren	(der) -en	(des) -en.	Der ſchöneren, of the fairer.
D.	Dem ſchöneren	(der) -en	(dem) -en.	Den ſchöneren, to the fairer.
A.	Den ſchöneren	(die) -e	(das) -e.	Die ſchöneren, the fairer.

(*c*) MIXED FORM.

	MASC. SING.	FEM. SING.	NEUT. SING.
N.	Unſer ſchönerer	(unſere) -e	(unſer) -es, our fairer.
G.	Unſeres ſchöneren	(unſerer) -en	(unſeres) -en, of our fairer.
D.	Unſerem ſchöneren	(unſerer) -en	(unſerem) -en, to our fairer.
A.	Unſeren ſchöneren	(unſere) -e	(unſer) -es, our fairer.

PLURAL FOR ALL GENDERS.

Nom.	Unſere ſchöneren, our fairer.
Gen.	Unſerer ſchöneren, of our fairer.
Dat.	Unſeren ſchöneren, to our fairer.
Acc.	Unſere ſchöneren, our fairer.

Sometimes the e in the endings of pronouns and comparatives is omitted or transposed; thus, instead of unſeres ſchöneren, we may say unſers ſchönern, or unſres ſchönern.

In the superlative of the old form, the vocative only is used—a case which has not been set down in the paradigms, or examples, because it is always like the nominative in form.

EXAMPLES OF THE SUPERLATIVE.

(*a*) OLD FORM.

	Singular.		
	MASC.	FEM.	NEUT.
Voc.	Liebſter Vater! O dearest father!	Theuerſte Schweſter! O dearest sister!	Schönſtes Kind! O most beautiful child.

Plural.

Voc. Liebſte Väter!	Theuerſte Schweſtern!	Schönſte Kinder!
O dearest fathers!	O dearest sisters!	O most beautiful children.

(*b*) NEW FORM.

	Singular.			*Plural.*
	MASC.	FEM.	NEUT.	FOR ALL GENDERS.
N.	Der ſchönſte	(die) -e	(das) -e.	Die ſchönſten, the fairest.
G.	Des ſchönſten	(der) -en	(des) -en.	Der ſchönſten, of the fairest.
D.	Dem ſchönſten	(der) -en	(dem) -en.	Den ſchönſten, to the fairest.
A.	Den ſchönſten	(die) -e	(das) -e.	Die ſchönſten, the fairest.

(*c*) MIXED FORM.

	MASC. SING.	FEM. SING.	NEUT. SING.
N.	Unſer ſchönſter	(unſere) -e	(unſer) -es, our fairest.
G.	Unſeres ſchönſten	(unſerer) -en	(unſeres) -en, of our fairest.
D.	Unſerem ſchönſten	(unſerer) -en	(unſerem) -en, to our fairest.
A.	Unſeren ſchönſten	(unſere) -e	(unſer) -es, our fairest.

PLURAL FOR ALL GENDERS.

Nom.	Unſere ſchönſten, our fairest.
Gen.	Unſerer ſchönſten, of our fairest.
Dat.	Unſeren ſchönſten, to our fairest.
Acc.	Unſere ſchönſten, our fairest.

OBSERVATIONS.

In place of the regular form of the superlative, preceded by the article and agreeing with the noun in gender, number, and case, we often find a circumlocution employed, which consists in the dative case singular of the new form preceded by the particle am: thus, Die Tage ſind im Winter am kürzeſten, the days are shortest in the winter. The explanation is easy; am, compounded of an (*at*) and dem, the dative of der (*the*), signifies "*at the.*" Translated literally, therefore, the sentence above will be, "The days in winter are *at the* shortest" (that is, "at the shortest *limit*"), where in the German kürzeſten agrees with some noun in the dative understood, which is governed by an. But the phrase is used and treated just as any regular superlative form would be under the same circumstances. In like manner, auf (*upon*) and zu (*to*) combined respectively with the article (auf das and zu dem), and producing the forms aufs and zum, are employed with adjectives in the superlative: thus, Aufs ſchönſte eingerichtet, arranged upon the finest (*plan*); zum ſchönſten, to *or* according to the finest (*manner*). These latter forms, however, are chiefly employed to denote *eminence*, rather than to express *comparison*. Freely rendered, therefore, aufs ſchönſte and zum ſchönſten will be, *very finely, most beautifully*, or the like.

Sometimes aller (*of all*) is found prefixed to superlatives to give intensity of meaning, as:—Der allerbeſte, the best of all (*i.e.*, the *very* best); Die allerſchönſte, the handsomest of all (*i.e.*, the *very* handsomest).

When mere *eminence*, and not *comparison*, is to be expressed, the words äußerſt (*extremely*) and höchſt (*highest*) are employed, as:—Dies iſt eine äußerſt ſchöne Blume, this is a very beautiful flower.

IRREGULAR AND DEFECTIVE FORMS.

I. IRREGULAR.

Positive.	*Comparative.*	*Superlative.*
Gut, good;	beſſer, better;	beſt *or* am beſten, best.
Hoch, high;	höher, higher;	höchſt *or* am höchſten, highest.
Nahe, near;	näher, nearer;	nächſt *or* am nächſten, nearest.
Viel, much;	mehr, more;	meiſt *or* am meiſten, most.
Wenig, little,	minder, less;	mindeſt *or* am mindeſten, least.
Groß, great;	größer, greater;	größt *or* am größten, greatest.
Bald early;	eher, earlier;	erſt *or* am erſten, earliest

II. DEFECTIVE.

The following want the positive:—

Äußer, outer;	äußerſt, uttermost.
Inner, inner;	innerſt, innermost.
Vorder, fore;	vorderſt, foremost.
Hinter, hinder;	hinterſt, hindermost.
Ober, upper;	oberſt, uppermost.
Unter, under;	unterſt, undermost.

Letzt *or* am letzten (latest) wants both positive and comparative.

OBSERVATIONS.

Note that hoch (high) in the comparative drops, while nah (near) in the superlative assumes, the letter c. Thus, hoch, comparative höher, nah, comparative näher, superlative nächſt.

Note also that mehr (more), the comparative of viel, has two forms in the plural, mehre or mehrere, and that the latter (mehrere) is the more common one. It has the use and meaning of the English word *several*, as:—Ich ſah mehrere Soldaten, I saw several soldiers;

That the superlative of groß (great) is contracted into größt;

That erſt, the superlative of eher (earlier), is a contraction for eheſt;

That from der erſte (the earliest *or* first) and der letzte (the latest *or* last) are formed the correlative terms erſterer (the former) and letzterer (the latter);

That the words in the preceding list of defectives are formed from adverbs, and are comparatives in *form* rather than in *fact*.

ADJECTIVES COMPARED BY MEANS OF ADVERBS.

When the degrees of comparison are not expressed by suffixes, the adverbs mehr (more) and am meiſten (most) are employed for that purpose; thus—

Positive.	*Comparative.*	*Superlative.*
Eingedenk, mindful;	mehr eingedenk, more mindful;	am meiſten eingedenk, most mindful.
Irre, astray;	mehr irre, more astray;	am meiſten irre, most astray.
Leid, sorry;	mehr leid, more sorry;	am meiſten leid, most sorry.

OBSERVATIONS.

The above method of comparison, which is commonly called the *compound form*, is chiefly used in cases—

Where a comparison is instituted between two different qualities of the same person or thing, as:—Er iſt mehr luſtig als traurig, he is more merry than sad; Er war mehr glücklich als tapfer, he was more fortunate than brave;

Where the adjectives, like those in the list above, are never used otherwise than as predicates;

Where the addition of the suffixes of comparison would offend against *euphony*, as in the superlative of adjectives ending in -iſch; thus, barbariſch, barbarous.

TRANSLATION FROM GERMAN.

Das Rothkehlchen.

Ein Rothkelchen kam in der Strenge des Winters an das Fenſter eines frommen Landmanns, als ob es gern hinein chte. Da öffnete der Landmann ſein Fenſter und nahm zutrauliche Thierchen freundlich in ſeine Wohnung. Nun s die Broſamen und Krümchen auf, die von ſeinem ielen. Auch hielten die Kinder des Landmanns das Vögelein lieb und werth. Aber als nun der Frühling wieder in das Land kam und die Gebüſche ſich belaubten, da öffnete der Landmann ſein Fenſter, und der kleine Gaſt entflog in das nahe Wäldchen, und bauete ſein Neſt und ſang ſein fröhliches Liedchen.

Und ſiehe, als der Winter wiederkehrte, da kam das Rothkehlchen abermals in die Wohnung des Landmanns und hatte ſein Weibchen mitgebracht. Der Landmann aber ſammt ſeinen Kindern freuten ſich ſehr, als ſie die beiden Thierchen ſahen, wie ſie aus den klaren Äuglein zutraulich umherſchauten; und die Kinder ſagten: „Die Vögelchen ſehen uns an, als ob ſie etwas ſagen wollten."

Da antwortete der Vater: „Wenn ſie reden könnten, ſo würden ſie ſagen: Freundliches Zutrauen erwecket Zutrauen, und Liebe erzeuget Gegenliebe!"

PLANE TRIGONOMETRY.—V.

[*Continued from p.* 56.]

SOLUTION OF OBLIQUE-ANGLED PLANE TRIANGLES.

XXI. ***Solution of Oblique-angled Plane Triangles.***—It has been already explained (Section X.) that any plane triangle can be computed when three out of its six "elements" are given, provided that at least one side be given. By aid of the formulæ developed in the last section, we proceed to show this in the three following cases, which include all that can be presented; viz.:—

1. Where three sides are given.
2. Where two sides and one angle are given.
3. Where one side and two angles are given.

1. *Given the three sides a, b, c.* Find A, B, and C. The simplest way to effect this is by (76),

$$\text{Tan.}\ \tfrac{1}{2}\,\text{A} = \sqrt{\frac{(s-b)\,(s-c)}{s\,(s-a)}}\,;$$

$$\therefore\ \text{log. tan.}\ \tfrac{1}{2}\,\text{A}$$

$$= 10 + \frac{\log.(s-b) + \log.(s-c) - \big(\log. s + \log.(s-a)\big)}{2}.$$

whence, by the table of logarithmic sines, tangents, etc., in Galbraith and Haughton's mathematical tables, ½ A, and therefore A, can be found.

Similarly, by (76),

$$\text{Log. tan.}\ \tfrac{1}{2}\,\text{B}$$

$$= 10 + \frac{\log.(s-a) + \log.(s-c) - \big(\log. s + \log.(s-b)\big)}{2}.$$

A and B being now known, C of course is known also.

Familiarity with the use of logarithms is necessarily assumed in the student, who will remember that, as 10 is added to all logarithms of trigonometrical ratios (to avoid the necessity of entering negative indices in the tables, which would otherwise arise from the fact that many of the ratios are less than unity), it is also necessary to deduct 10 from them before using them in calculations, or (what is the same thing) to add 10 to the other side of any equation in which they may appear. This has been done above. The use of logarithms is fully explained in our lessons in "Logarithms" in the NEW POPULAR EDUCATOR.

EXERCISE 4.

1. Given $a = 26$, $b = 31$, $c = 43$. Find the angles.
2. Given $a = 16{\cdot}22$, $b = 15{\cdot}82$, $c = 21{\cdot}56$. Find the angles.
3. Given $a = 1110$, $b = 1342$, $c = 1500$. Find the angles.
4. Given $a = 1{\cdot}32$, $b = 1$, $c = 0{\cdot}75$. Find the angles.

2. This case appears in two forms—

First, *given two sides, a and b, and the included angle* C. Find A, B, and c.

$$\tfrac{1}{2}\,(\text{A} + \text{B}) = \tfrac{1}{2}\,(180^\circ - \text{C}) = 90^\circ - \tfrac{1}{2}\,\text{C}.$$

Again, from (67),

$$\tan.\ \tfrac{1}{2}(A - B) = \frac{\tan.\ \tfrac{1}{2}(A + B) \times (a - b)}{a + b};$$

$$\therefore \log.\ \tan.\ \tfrac{1}{2}(A - B) = \log.\ \tan.\ \tfrac{1}{2}(90^\circ - \tfrac{1}{2}C) + \log.\ (a - b) - \log.\ (a + b).$$

There being a logarithmic ratio on each side of this equation, of like sign, there is no occasion to allow for the *added tens*, which balance each other.

We have now obtained $\frac{1}{2}(A + B)$ and $\frac{1}{2}(A - B)$, the sum and difference of which, by the well-known rule, give the values of A and B respectively.

By (65), we have $c = \dfrac{a \cdot \sin.\ C}{\sin.\ A}$;

$$\therefore \log.\ c = \log.\ a + \log\ \sin.\ C - \log.\ \sin.\ A.$$

Here again, owing to difference of sign, the "added tens" balance each other.

Secondly, *given two sides, a and b, and an angle*, A, not *included between them*. (This is called "the ambiguous case.") Find B, C, and c.

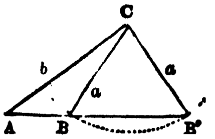

Fig. 14.

Fig. 15.

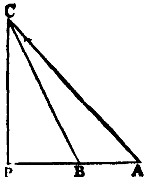

Fig 16.

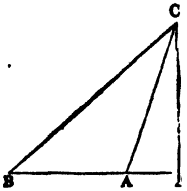

Fig. 17.

We find B readily from (65); viz., $\dfrac{\sin.\ B}{\sin.\ A} = \dfrac{b}{a}$;

whence $\log.\ \sin.\ B = \log.\ \sin.\ A + \log.\ b - \log.\ a$;

and $C = 180^\circ - (A + B)$,

c is found from (65), as in the last example.

Now since sin. B is also sin. $(180^\circ - B)$, the above equation for log. sin. B always admits of two values of B (except when $B = 90^\circ$), one greater and the other less than a right angle; and other data have to be considered in determining which is the correct one; thus—

(α) If the given angle A is a right angle, or greater than a right angle, B must be less than 90°, and no doubt arises.

(β) Again, if A, though less than a right angle, together with the *greater* value of B, be not less than 180°, it is clear the *less* value of B must be adopted. For instance, if $A = 80^\circ$ and $B = 70^\circ$ or 110° (*i.e.*, $180^\circ - 70^\circ$), it is plain that 110° is an inadmissible value for B; consequently, $B = 70^\circ$ and $C = 30^\circ$.

(γ) But if A, together with the greater of the two values of B, be less than 180°, it is plain that the data given apply to *two* triangles. Thus, if $A = 80^\circ$ and $B = 85^\circ$ or 95°, we may have either

$$A = 80^\circ;\ B = 85^\circ;\ C = 15^\circ;$$
$$\text{or } A = 80^\circ;\ B = 95^\circ;\ C = 5^\circ;$$

these alternative values being quite consistent with the fact that a and b are fixed values, as appears by Fig. 14, where both the triangles A B C and A B' C correspond with the data given.

It appears, however, by inspection of Fig. 14, that the ambiguity can *never* arise when a is greater than b, since then one of the two equal lines which may still be drawn from C to A B (or A B produced) will fall *to the left of* A, an impossible position for a side of a triangle in which A is an angle. This is a restatement of (β) in a more convenient form.

We may thus sum up:—*The ambiguity can only occur when the given angle is acute, and when the side opposite to it is less than the other given side.*

When these conditions are fulfilled, both values of B must be worked out, causing two values of C and two of c.

Exercise 5.

1. Given $a = 218$, $b = 156$, and $C = 38^\circ\ 21'\ 20''$. Find A, B, and c.

2. Given $a = 53{\cdot}24$, $b = 31{\cdot}27$, and $C = 126^\circ\ 30'\ 6''$. Find A, B, and c.

3. Given $b = 173$, $c = 123$, and $A = 22^\circ\ 18'\ 30''$. Find B, C, and a.

4. Given $b = 156$, $c = 130$, $A = 42^\circ\ 25'$. Find B, C, and a (give both solutions).

5. Given $a = 58$, $c = 47$, $C = 36^\circ\ 42'\ 30''$. Find A, B, and b (assume A to be acute).

3. *Given one side, a, and two angles* A *and* B. Find C, b, and c.

$$180^\circ - (A + B) = C.$$

By (65), $\dfrac{b}{a} = \dfrac{\sin.\ B}{\sin.\ A}$;

$$\therefore \log.\ b = \log.\ a + \log.\ \sin.\ C - \log.\ \sin.\ A.$$

Similarly, $\log.\ c = \log.\ a + \log.\ \sin.\ C - \log.\ \sin.\ A$.

Exercise 6.

1. Given $a = 217$, $B = 56^\circ\ 21'\ 30''$, $C = 62^\circ\ 41'\ 20''$. Find A, b, and c.

2. Given $a = 1000$, $B = 120^\circ\ 15'\ 15''$, $C = 36^\circ\ 52'$. Find A, b, and c.

XXII. *To find the Area of a Triangle.*—There are two useful formulæ for finding the area—one in terms of any two sides and included angle, the other in terms of the three sides.

1. Area $= \frac{1}{2} bc$ sin. A.

If A is a right angle, area evidently = half the rectangle under the adjacent sides, which agrees with the statement, since sin. $90° = 1$.

If A is acute, as in Fig. 15, drop C P perpendicular to A B, or A B produced (Fig. 16). Then, by Euclid II. 1,

$$\text{Area} = \tfrac{1}{2}\,\text{A B} \times \text{C P}.$$

But A B = C, and since $\frac{\text{C P}}{b} =$ sin. A, C P $= b$ sin. A;

therefore area $= \frac{1}{2} bc$ sin. A.

If A be obtuse (Fig. 17), drop C P as before, on B A produced; then

$$\text{Area} = \tfrac{1}{2}\,\text{A B} \times \text{C P},$$

But A B $= c$ and C P = C A sin. C A P, and sin. C A P = supplement of A.

$$\therefore \text{ Area } \tfrac{1}{2}\, bc \text{ sin. A} \ldots\ldots\ldots\ldots\ldots \quad (77)$$

Or, log. 2 area = log. b + log. c × log. sin. A − 10.

2. Substituting in (77) the value of sin. A given in (73), we get

$$\text{Area} = \sqrt{s\,(s-a)\,(s-b)\,(s-c)} \ldots\ldots \quad (78)$$

Or log. area

$$= \frac{\text{log. } s + \text{log. } (s-a) + \text{log. } (s-b) + \text{log. } (s-c)}{2};$$

but it is often easier to work out (77) arithmetically than to employ logarithms.

EXERCISE 7.

1. Given $b = 35$ feet, $c = 117$ feet, and $A = 27°$. Find the area.
2. Given $a = 1000$ yards, $b = 2{\cdot}5$ miles, and $C = 42°$. Find the area.
3. Given $b = 2{\cdot}314$, $c = 1{\cdot}527$, and $A = 49° 6' 20''$. Find the area.
4. Given $a = 287{\cdot}1$, $c = 310{\cdot}25$, and $B = 114° 28' 32''$. Find the area.
5. Given $a = 49$, $b = 98$, $c = 53$. Find the area without employing logarithms.
6. Given $a = 608$, $b = 507$, $c = 721$. Find the area.
7. Given $a = 0{\cdot}45$, $b = 0{\cdot}34$, $c = 0{\cdot}23$. Find the area.
8. Given $a = 2{\cdot}05$, $b = 1{\cdot}67$, $c = 2{\cdot}7$. Find the area.

We have now concluded our investigation of theoretic Trigonometry, or rather of such parts of the theory as will enable us to apply our knowledge largely in practice. There are formulæ for other ratios or values, such as for the radius of the circle inscribed in, or circumscribed about, a given triangle, the area of the circumscribed circle in terms of the sides, the area of any polygon inscribed in a circle (whence the area of the circle itself may be obtained approximately), and the like; but these, although useful, are not needed to enable us merely to solve "heights and distances," upon which the practical art of surveying mainly depends. A complete survey of a coast or country may be made, and heights and distances accurately calculated, without a single actual measurement being taken, except one at starting called the *base-line*. (It is usual, however, to check a result here and there by actual measurement.) By choosing or marking spots or objects at convenient distances apart, the whole district is divided into triangles, and it is obvious that a knowledge of one side of the first triangle calculated (the base-line before mentioned), an instrument for measuring angles, and a level, are all that are required to enable it to be completely surveyed.

APPLICATION OF TRIGONOMETRY TO MEASUREMENT.

The object of this lesson is to suggest rather than enumerate the practical uses of the science. Apart from its connection with Navigation—upon which more will be said in the papers shortly to be devoted to that subject—Trigonometry is plainly employed in the practical work of measuring (1) heights and distances, (2) areas, and (3) contents of solids. By way of example we will take one or two of its simpler applications to the measurement of heights and distances, space forbidding even the enumeration of the many problems which may arise in measuring and surveying—most of which may, however, be solved, directly
formulæ already arrived at.

PROBLEM I.—To find the height of an inaccessible object situated on a horizontal plane (Fig. 18).

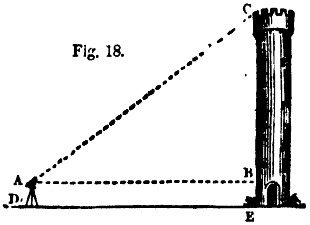
Fig. 18.

Let the tower E C be the object. Measure from it a convenient distance, E D, and observe the angle B A C. The right-angled triangle A B C can now be calculated (B C = A B · tan. B A C; *see* Section X.), one side, A B (equal to E D), and one angle being known. To B C add E B, the height of the observer's eye above the horizontal plane, and we obtain the height of the tower.

EXERCISE 8.

1. A person whose eye is 5 ft. 6 in. above the ground, having receded 125 ft. from the base of a tower, finds that its angular elevation is 52° 34′. Calculate its height.
2. From the other side of a street 42 ft. wide, I observe that the elevation of the front of a house is 49° 28′. What is the height of the house, the height of my eye being 5 ft.?

PROBLEM II.—To find the distance on a horizontal plane of an object of known height.

Let the tower in Fig. 18 be the object, and its distance from D—*i.e.*, the length of A D—be the information sought. The angle B A C being found as before, this case differs from the preceding only in that a different side of the triangle is given, and it is calculated with equal ease by the means pointed out in Section X.

EXERCISE 9.

1. The angle which a man's height subtends at the eye is 10′. If his height is assumed to be 6 ft., calculate his distance.

2. The pyramid of Cheops is 490 ft. high. From a distant point of the plain on which it stands, the elevation of its apex is observed to be 13° 40′. Calculate its horizontal distance.

PROBLEM III.—To find the height and distance of an inaccessible object on a horizontal plane (Fig. 19).

The simplest way to do this is to observe its elevation at two points, A and B, in line with the object, measuring their distance apart. Let the observed angles be α and β respectively. Angle A C B $= \beta - \alpha$; whence, by the *rule of sines*,

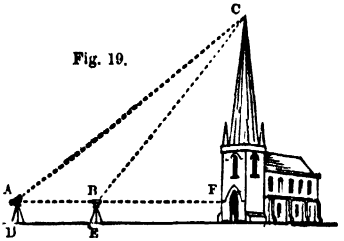
Fig. 19.

$$BC = AB \times \frac{\sin. \alpha}{\sin. (\beta - \alpha)};$$

$$\text{but } FC = BC \cdot \sin. \beta;$$

$$\therefore FC = AB \times \frac{\sin. \alpha \sin. \beta}{\sin. (\beta - \alpha)};$$

$$\text{and similarly, } FB = AB \times \frac{\sin. \alpha \cos. \beta}{\sin. (\beta - \alpha)}.$$

F C, added to height of observer's eye, gives the height, and F B gives the distance of the object.

EXERCISE 10.

1. Wishing to ascertain the height of a church steeple, to which close access cannot be had, I select two stations in line with it 52 yds. apart. At those stations I find the elevations to be 58° 14′ and 36° 42′ respectively. The height of my eye above the ground is 4 ft. 6 in. What is the height of the steeple?

2. What is the height of a hill, its angle of elevation at the bottom being 52°, while 300 yds. from the bottom, measured horizontally, its elevation is found to be 28° 30′?

If the nature of the ground prevents two observations being taken in line with the object, they may be taken as at A B in Fig. 20. Measure A B and the angles B A C, A B C, and F A C, which we will call α, β, and ϕ respectively. (The two former must be measured by a sextant.) Then, since A C B = supplement of $\alpha + \beta$, ∴ sin. A C B = sin. ($\alpha + \beta$;

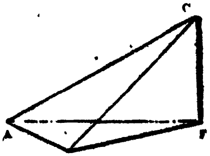
Fig. 20.

$$\therefore AC = AB \times \frac{\quad}{\sin. (\alpha + \beta)}$$

$$\text{But } FC = AC \cdot \sin. \phi;$$

$$\therefore FC = AB \times \frac{\sin. \beta \sin. \phi}{\sin. (\alpha + \beta)};$$

and similarly for the distance.

PROBLEM IV.—To find the distance of an inaccessible object without measuring its elevation, and whether on a horizontal plane or not (Fig. 21.)

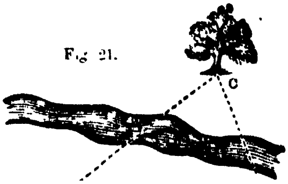
Fig. 21.

Let C be the object and A the point of observation; select any other point, B, and measure A B and the angles C A B and A B C. A C may be calculated by Section XXI., par. 3. If B be taken so that A B C be a right angle, the case, of course, is still simpler.

EXERCISE 11.

1. In order to ascertain the distance of a windmill on the opposite side of a river, I observe the angle between the windmill and a flagstaff, which is 350 yds. distant, and find it to be 53° 4′. Proceeding to the flagstaff, I find the angle between the windmill and the first station to be 49° 10′. What is the distance of the windmill?

2. Wanting to know the breadth of a river, I measure along the bank a base of 250 ft., the extremities of which we will call A and B. At the extremity A I find the angle made by B and a tree on the opposite bank is 63° 31′; at the extremity B I find the angle between A and the tree is 57° 28′. What is the breadth of the river?

PROBLEM V.—To find the distance from each other of two inaccessible objects (Fig. 22).

Let C and D be the objects. Measure a base-line, A B, and observe the angles A B C, A B D, B A C, B A D. Calculate A C and A D as in the last problem. Then, since C A D = B A C − B A D, we have the necessary materials for calculating the triangle A C D (Section XXI., par. 2). Hence we obtain the distance, C D.

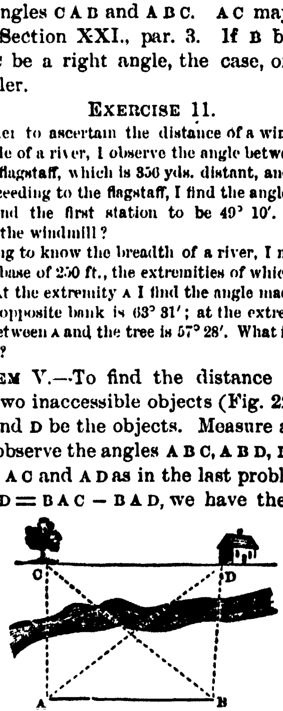
Fig. 22.

EXERCISE 12.

1. To ascertain the distance between two batteries in an enemy's works, a base line of 500 yds. is measured, and the angles which each battery makes with the base-line are observed to be 118° 20′ and 46° 14′ at one extremity, and 88° 48′ and 38° 12′ at the other. What is their distance apart?

There is an ingenious way of finding the converse of this problem—viz., the distance between A and B —by observations upon C and D, the distance between *the latter* being known. *Assume* A B = 1000; then, on that supposition, calculate C D, without reference to its real value. Then, as the *calculated* value of C D is to the *real* value, so is 1000 to the real value of A B.

EXERCISE 13.

1. In a coast survey, observations are made from two rocks, A and B, at sea, on a lighthouse and a headland, which are 2857 yds. apart. At A the lighthouse bears 78° 32′ and the headland 86° 24′ from B. At B the headland bears 65° 15′ and the lighthouse 28° 42′ from A. Required the distance between the rocks, and their bearings from the lighthouse and the headland.

PROBLEM VI.—To find the height of an inaccessible object situated about the plane of observation, and its height above that plane (Fig. 23).

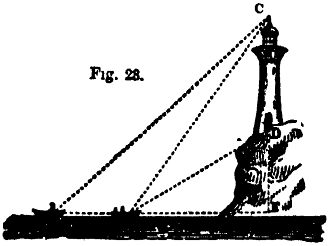

Fig. 23.

Take two stations, A and B, in line with the object, and measure A B; observe the angles B A C, F B C, F B D. From the first two the total height, F C, and the distance, F B, may be obtained, as in Problem III. F B and F B D being known, F D is obtained as in Problem I. F D = height above plane of observation, and F C - F D = height of object.

EXERCISE 14.

1. In order to find the dimensions of a window of a cathedral, which is inaccessible, I select two stations in front of it, 54 ft. apart. From the far station the elevation of the top of the window is 31° 38′; and from the near station the elevations of the top and bottom are 48° and 30° 30′ respectively. What is its height, and how high above the ground?

2. A castle standing on the top of a cliff is observed from two stations at sea, which are in a line with it, and a quarter of a mile apart. The elevation of the top of the castle, seen from the remote station, is 16° 28′; the elevations of the top and bottom, seen from the near station, are 52° 14′ and 48° 38′ respectively. What is its height, and what its elevation above the sea?

KEY TO EXERCISES.

EXERCISE 4.

1. A = 36° 49′ 36″; B = 45° 37′; C = 97° 33′ 24″.
2. A = 48° 38′ 53″; B = 45° 9′ 17″; C = 86° 11′ 55″.
3. A = 45° 33′ 34″; B = 50° 40′ 43″; C = 75° 45′ 40″.
4. A = 96° 53′ 16″; B = 48° 46′ 24″; C = 34° 20′ 17″.

EXERCISE 5.

1. A = 96° 18′ 24″; B = 45° 20′ 16″; *c* = 136·1.
2. A = 84° 8′ 58″; B = 19° 15′ 1″; *c* = 76·14.
3. B = 110° 34′ 58″; C = 38° 11′ 32″; *a* = 75·24.
4. B = 54° 2′ 20″, or 125° 57′ 40″; C = 83° 32′ 40″, or 11° 37′ 20″; *a* = 191·5, or 88·83.
5. A = 42° 22′ 49″; B = 100° 54′ 41″; *b* = 77·206.

EXERCISE 6.

1. A = 60° 57′ 10″; *b* = 206·65; *c* = 220·55.
2. A = 22° 52′ 45″; *b* = 2221·8; *c* = 1543·1.

EXERCISE 7.

1. 929·54452 sq. ft.
2. ·47523 sq. miles.
3. 1·335.
4. 40535.
5. 692·387.
6. 1507·9.
7. ·03816.
8. 1·710

EXERCISE 8.

1. 163·8 ft. 2. 54·12 ft.

EXERCISE 9.

1. 2062·65 ft. 2. 1992·4 ft.

EXERCISE 10.

1. 220·45 ft. 2. 848·6 ft.

EXERCISE 11.

1. 275·6 yds. 2. 220 ft.

EXERCISE 12.

1. 761 9 yds.

EXERCISE 13.

1. Distance apart = 4403 yds. At the lighthouse, A bears 160° 33′, and B 33° 47′ from the headland. At the headland, B bears 100° 40′, and A 31° 19′ from the lighthouse.

EXERCISE 14.

1. Height of window = 24·639 ft.; height above ground = 49 187 ft.
2. Height = 60·82 ft.; height above sea = 445·23 ft.

ELECTRICITY.—XI.

[*Continued from p.* 61]

GENERATION OF ELECTRIC CHARGES—ABSOLUTE SYSTEM OF UNITS—DEFINITIONS—CONDENSERS.

It is a well-known fact that all non-conducting bodies, when rubbed, acquire the property of attracting light bodies, and for this reason they were known as *electrics;* it is not so well known—but is nevertheless true—that all good conducting bodies acquire the same property provided proper precautions are taken. A glass rod when rubbed with silk acquires this property, as can be seen by bringing it near to a pith-ball which is suspended by a long silk thread. On approaching the glass rod the pith-ball is attracted towards it, and this attraction increases till contact occurs between the two; immediately after contact, however, the pith-ball flies off, and from that time forward repulsion takes place between them. If the silk with which the glass has been rubbed be now brought near the ball, attraction takes place between them. We have, therefore, the phenomenon of the pith-ball which has touched the glass being attracted by the silk, at the same time that it is being repelled by the glass. If the order of the experiment had been reversed, that is to say, had the pith-ball been first brought into contact with the silk, it would now be attracted by the glass and repelled by the silk. All this means that the operation of rubbing and then separating the glass and silk generated electric charges on them, and that these charges were equal in quantity but diametrically opposite *in kind.* The charge generated on the glass has been called positive, usually denoted by the sign plus +, and that generated on the silk negative, usually denoted by the sign minus −. The pith-ball had originally no charge, but on being brought into contact with the glass it acquired a + charge, and from that instant forward it was repelled by the glass; thus showing that *two positively charged bodies repel each other.* At the same time it was attracted by the silk; thus showing that *a positively and a negatively charged body attract other.* The same process of reasoning shows that *two negatively charged bodies repel each other.*

Fig. 60.—Double Aurora Arcs, seen at the Winter Quarters of the "Vega," March 20, 1879.

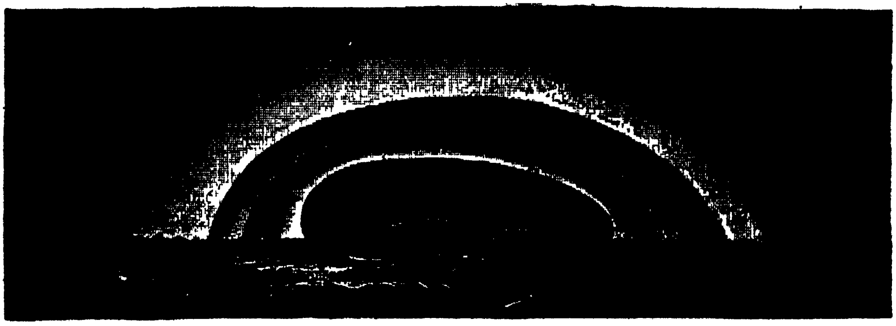

Fig. 61.—Elliptic Aurora, seen at the Winter Quarters of the "Vega," March 21, 1879.

The kind of charge generated on any body by rubbing entirely depends upon the substance with which it is rubbed, but it must be borne in mind that one kind can never be generated alone; whenever a positive charge is generated, there must of necessity be an exactly equal negative charge generated somewhere else; and conversely, whenever a negative charge is generated, there must also be an exactly equal positive charge generated.

The following is a list of a few substances arranged so that any body becomes positively charged when rubbed by any that is lower on the list.

Cat's-skin,
Glass,
Silk,
The Hand,
Sulphur,
Flannel,
Shellac,
Resin,
Gutta-percha,
etc.

It was mentioned that the pith-ball was suspended by a silk thread; the object of the silk was to prevent the charge which was given to the body from leaking away, and this leads to the explanation of the statement made in the opening sentence that "good conductors also become charged when rubbed." They most certainly become charged when rubbed, but owing to the very fact that they are good conductors they lose their charges by leakage as quickly as they are generated, and thus no charges appear on them when subjected to the most delicate tests. If, however, the leakage be prevented—either by suspending them by a silk thread, or by fixing them on the end of a non-conducting rod—they will retain their charges like non-conductors.

The existence of a charge of one kind implies the existence of an exactly equal charge of the opposite kind, though the position of this second charge is not always apparent. If a positively charged body is suspended by a silk thread in a room, the corresponding negative charge will be found distributed over the walls, floor, and ceiling, but principally on those places in closest proximity to the suspended body. Similarly, a negatively charged body will always attract an exactly equal positive charge on neighbouring conducting objects.

UNITS OF MEASUREMENT.

The system of units universally used for scientific purposes is the centimetre-gramme-second system, and in terms of these three fundamental units all physical quantities can be expressed; it is usually known as the C.G.S. system, and its English equivalents are as follows:—

CENTIMETRE = ·3937 inch = the unit of length,
GRAMME = 15·432 grains = the unit of mass,
SECOND = the unit of time.

From these three fundamental units the following, as well as all other units, are derived:—

Velocity.—A body moves with unit velocity when it moves at the rate of one centimetre per second.

Acceleration.—The unit of acceleration is that acceleration which, acting on a body for one second, imparts to it unit velocity; or, it is an acceleration of one centimetre-per-second per second. (In the following calculations the acceleration due to gravity will be assumed as 981 centimetres per second; this being approximately the velocity per second that gravity imparts to a falling body.)

Force.—The unit of force is called the *dyne*. It is that force which, acting on a mass of one gramme for a period of one second, imparts to it a velocity of one centimetre per second.

Work.—The unit of work is called the *erg*. It is the amount of work done in overcoming a force of one dyne over a distance of one centimetre.

Heat.—The unit of heat is called the *caloric*. It is the quantity of heat required to raise the temperature of one gramme of water from 0° to 1° Cent.

1 calorie = 42,000,000 ergs.

Unit of Quantity (Electrical).—In speaking of the electric charges on bodies it is necessary to have some unit in terms of which the amount of such charges can be measured. Two similarly charged bodies will—as has been explained—repel each other, and the force of this repulsion will depend upon the amount of charge on each body, as well as upon the distance that separates them. For small bodies the force will be proportional to the product of the two charges, and will be inversely proportional to the square of the distance between them. This law is due to Coulomb, and supplies us with a definition of unit quantity. It is best expressed in symbols thus:—

$$F = \frac{q_1 \times q_2}{d^2}.$$

where F = the force of repulsion in dynes.
,, q_1 = the quantity of charge on one body.
,, q_2 = ,, ,, ,, the other body.
,, d = the distance in centimetres between them.

If now the distance d is made one centimetre, if the force of repulsion F is one dyne, and if the charges are equal, then we at once obtain a definition for unit quantity of electricity in terms of the fundamental units, thus:—*Unit quantity is that quantity which, when placed at a distance of one centimetre from an equal and similar quantity in air, repels it with a force of one dyne.*

Unit difference of Potential.—Considering any two similarly charged bodies A and B, a force of repulsion always exists between them. If A moves up toward B it must do work in overcoming the force of repulsion, and the amount of work done is the product of the distance moved into the average force. If A moves from an infinite distance up to a fixed position near B it does work in the process, and the work thus done can be recovered if A is now allowed to move from the fixed position away to an infinite distance. Work must be done on A in bringing into position, but when there, A is capable of doing an exactly equal amount of work in moving away from the position. When in the fixed position A clearly has *potential* energy stored up in it, or energy due to its position. If A contains unit quantity of electricity, and we can measure the work done on it in bringing it up to any position, we know the potential at that point, since the work done on A is the measure of the potential. *The potential at any point is the amount of work that must be done on unit quantity of positive electricity in bringing it to that point from an infinite distance.*' The difference of potential between any two points is therefore the amount of work that must be done on unit quantity of positive electricity in moving it from one point to the other. *Unit difference of potential (or of electromotive* *force) exists between two points when it requires the expenditure of one erg to move unit quantity of positive electricity from one point to the other.*

Unit Current.—Unit current is that current which is caused by the passage of unit quantity across any section in one second.

PRACTICAL ELECTRICAL UNITS.

The Ampere = the unit of current and is equal to $\frac{1}{10}$th of the absolute unit.

The Volt = the unit of electromotive force, and equals 100,000,000 absolute units.

The Ohm = the unit of resistance, and equals 1,000,000,000 absolute units.

CONVERSION OF MECHANICAL INTO ELECTRICAL ENERGY.

This most important problem follows as a deduction from what has gone before, and will be quite simple to those who have read it carefully. It is required to find the horse-power which is being expended in any portion of a circuit through which a known current, and a known E.M.F. are working

Let V_1 and V_2 be the potentials at the two points between which it is required to find the horse-power that is being expended.

Let C = the current flowing in the circuit,
„ E = the E.M.F. between the two points,
Then $E = V_2 - V_1$ = the work in ergs done on one unit of positive electricity in moving from one point to the other.
∴ EQ = the work in ergs done on Q units in moving them from one point to the other.

But according to the above definition of unit quantity $Q = C\,t$,

where t = the time in seconds during which the current has been flowing.

Substituting this value for Q,

$E\,C\,t$ = work in ergs expended in t seconds by a current C and an E.M.F of E.
∴ EC = work in ergs expended in one second by a current C and an E.M.F. of E.

Both E and C have so far been expressed in absolute units, and in order to express them in volts and amperes,

Multiply E by 100,000,000 to reduce to volts.
Divide C by 10 „ „ „ amperes.

The above expression then becomes

10,000,000 EC = work in ergs per second.

If E = one volt and C = one ampere,

Then one volt-ampere = 10,000,000 ergs per second.

This quantity is known as the *Watt.*

The left-hand side of this equation has been reduced to the practical units; it now remains to reduce the right-hand side to horse-power.

One erg = one dyne × one centimetre.

And gravity exerts a pull on a mass of one gramme of 981 dynes.

∴ The work done in raising one gramme through a height of one centimetre = 981 ergs,
but 1 foot = 30·48 centimetres,
and 1 pound = 453·6 grammes.

∴ The work done in raising one pound through a distance of one foot = 981 × 30·48 × 453·6 ergs,
or one foot-pound = 13,560,000 ergs.

Again, one horse-power = 33,000 foot-pounds per minute,
„ „ = 550 „ „ „ second,
„ „ = 550 × 13,560,000 ergs „ „
„ „ = 7,460,000,000 „ „ „

∴ 10,000,000 EC = 7,460,000,000 × horse-power,

$$\therefore \text{ Horse-power} = \frac{10{,}000{,}000\ E\,C}{7{,}460{,}000{,}000},$$

$$= \frac{E\,C}{746},$$

That is to say, multiply the E.M.F. in volts by the current in amperes and divide by 746 in order to find the horse-power being expended in any portion of the circuit.

CONVERSION OF ELECTRICAL ENERGY INTO HEAT.

From the definition we have

1 calorie = 42,000,000 ergs.

Inserting this value in the equation

10,000,000 EC = work in ergs per second.

$$\text{Heat in calories} = \frac{10{,}000{,}000\ E\,C}{42{,}000{,}000},$$

$$\text{Heat in calories per second} = \frac{E\,C}{4{\cdot}2},$$

Or when the current has been flowing for a certain time t seconds,

$$\text{Heat in calories} = \frac{E\,C\,t}{4{\cdot}2}.$$

Example 1.—On testing an arc lamp, which was giving a light of 1,500 candle-power, it was found that the E.M.F. at the terminals of the lamp was 50 volts, and the current passing was 10 amperes. What power was the lamp absorbing and what was its efficiency?

Substituting these values for E and C in the above equation, we get

$$\text{H-P} = \frac{50 \times 10}{746}.$$

$$= {\cdot}0366. \qquad \textit{Answer.}$$

In arc lighting the efficiency of a lamp is spoken of as so many candle-power per horse-power, therefore

$$\text{Efficiency} = \frac{\text{Candle-power} \times 746}{E\,C}$$

Substituting the values given in the example in this expression, we get

$$\text{Efficiency} = \frac{1500 \times 746}{10 \times 50}.$$

$$= 2284 \text{ candles per H-P.} \quad \textit{Answer.}$$

In incandescent lighting the efficiency of a lamp is spoken of as so many watts per candle, therefore

$$\text{Efficiency} = \frac{\text{E C}}{\text{Candle-power}}.$$

Example 2.—What is the power absorbed in a glow lamp which gives 16 candle-power, with an E.M.F. of 100 volts, and a current of ·6 ampere?

$$\text{Power} = 100 \times {\cdot}6$$

$$= 60 \text{ watts.} \quad \textit{Answer.}$$

$$\text{Efficiency} = \frac{100 \times {\cdot}6}{16}$$

$$= 3{\cdot}75 \text{ watts per candle.} \quad \textit{Answer.}$$

Example 3.—What quantity of heat is developed in the filament of the glow lamp (Example 2) in 5 minutes.

$$\text{Heat} = \frac{\text{E C } t}{4{\cdot}2}$$

$$= \frac{100 \times {\cdot}6 \times 5 \times 60}{4{\cdot}2}$$

$$= 4286 \text{ calories.} \quad \textit{Answer.}$$

Or sufficient heat to raise 4286 grammes of water through 1° Cent.

CONDENSERS.

If two non-conducting bodies, such as silk and glass, are rubbed together and then separated by a definite distance, it will be found that they will have equal charges, but of opposite kinds. It is often taken for granted that the greater the amount of rubbing the greater will be the charges produced, but this is a fallacy. The mere act of rubbing is useless except that it brings all parts of the two bodies *into contact.* If all parts of the two bodies could be brought into contact by any other means, and without the expenditure of any energy, the result—as far as the charges are concerned—would be exactly the same. *It is not the rubbing, it is the actual contact between the dissimilar substances that initially gives rise to the difference of potential between them.* The amount of this difference of potential depends upon the nature of the substances, and its value—which is called the *contact potential difference*—is well known for many substances.

It is now easy to understand where the comparatively large charges on the glass and silk come from. They have extremely small charges when in contact—owing to their contact potential difference—and in the act of separating them, work must be done in order to overcome the mutual attraction which takes place between them; in their final positions they therefore have a high potential which is the equivalent of the amount of work done in bringing them to those positions. Two insulated conducting bodies of dissimilar substances would in the same manner become charged if brought into contact and separated as above described.

The quantity of electricity in such a charged body—if sufficiently large—can be measured by an ordinary ballistic galvanometer, thus:—Connect one end of a wire to the charged body, and the other end to one terminal of the galvanometer, which is connected to earth by the other terminal. The charge on the body will instantly rush through the galvanometer in the form of an electric current which is strong in the beginning, but gradually falls off to zero as the body becomes discharged. The whole operation is practically instantaneous; but while it lasts, an actual current is flowing through the galvanometer, and this current naturally produces a throw, the amount of which gives a measure of the quantity accumulated on the charged body. The quantity thus measured is expressed in coulombs where the coulomb is defined as *that quantity which flows per second past any cross section of a conductor conveying one ampere.*

The quantity of charge that can be accumulated or condensed on any insulated body depends not only on its size, but also on its proximity to neighbouring bodies. If a charged plate A is close to an uninsulated one B,

it will induce on B an equal but opposite charge, and if the plate B be now insulated, let us consider what happens if the distance between them is varied. In their original positions they are at a certain potential difference, and attraction takes place between; if they are moved apart, work must be done against this attraction, and therefore the potential difference between them rises, and the greater the difference to which they are separated, the greater will be the potential difference between them. On the other hand, if they are allowed to move closer together under the action of their mutual force of attraction, the potential difference between them falls, and the closer they are together the smaller will it become. For any given positions of the plates the arrangement has a perfectly definite *capacity.* The capacity of any arrangement *is the number of coulombs that must be given to one plate in order to produce a potential difference of one volt between the two.* The capacity therefore can be increased by making the distance between the plates as small as possible. Such an arrangement is called a condenser, which may be defined as *two conductors separated by an insulator, and so arranged that the capacity is large compared with the size of the conductors.*

The capacity of a condenser depends not only upon the size of the plates, and upon the distance between them, but it also depends upon the nature of the insulating substance that separates them. If instead of air they are separated by paraffin-wax, the capacity will be nearly doubled; if separated by mica, the capacity will be five times as great. This means that each insulator has a property peculiar to itself which determines the capacity of the condenser in which it is used as the insulating substance. In a condenser the insulating substance is called the *dielectric*, and this property is called the *specific inductive capacity* of the dielectric. Air has been assumed as the standard, and the specific inductive capacities of a number of different substances are given in the following table :—

TABLE OF SPECIFIC INDUCTIVE CAPACITIES.

Substance.	Specific Inductive Capacity.
Air	1·0
Paraffin-wax	2 0
India-rubber (milky)	2·3
Resin	2·5
Ebonite	2 8
Sulphur	3·4
Shellac	3 5
Gutta-percha	4·2
Mica	5·0
Glass (very light)	6·5
„ (very dense)	10·0

If two conducting plates, separated by an insulator, are maintained at a fixed distance apart, and their difference of potential gradually raised to a sufficient amount, the dielectric between them becomes subjected to a continually increasing electric stress, which it can no longer withstand, but will be ruptured by the passage of an electric spark between the two plates, which will then be found to be discharged. The Aurora Borealis (Figs. 60 and 61) shows the manner in which this discharge occurs in a rarefied atmosphere. With different dielectrics, the quantity of electricity that can be given to the plates before discharge occurs varies greatly, but its amount is fairly well known for the different dielectrics; it must, however, be remembered that it has no connection either with the insulating property of the material, or with its specific inductive capacity. The capacity of a condenser is not the quantity that can be put into it before discharge takes place, it is the quantity in coulombs that must be put into it in order to obtain a potential difference between the plates of one volt.

The unit of capacity is called the **Farad**, but the condenser that would have a capacity of one farad would be so extremely large, that for practical purposes the microfarad (one-millionth of a farad) is the unit generally adopted; it is the capacity of a condenser which would have a potential difference of one volt when one-millionth of a coulomb was put into it. The capacity of any condenser depends upon three things, as can be expressed thus:

$$F = \frac{A}{d} S.$$

Where F = the capacity of condenser,
„ A = area of plates,
„ S = specific inductive capacity of dielectric.
„ d = distance between the plates.

It can therefore be increased by increasing the area of the plates, by diminishing the distance between them, and by using a dielectric of high specific inductive capacity.

The usual method of constructing a condenser of large capacity is as follows :—A number of sheets of tinfoil are cut with a projecting lug as shown in A, Fig. 62, and another set of the same size with their lugs turned to the opposite side, as shown in C; also a number of sheets of bank-note paper about two inches both ways larger than the tinfoil, B. The sheets of paper are then separately held up to the light, and any of those in which pin-holes occur are rejected. A bath containing melted paraffin-wax at a temperature of about 110° Cent. is also provided. A couple of sheets of paper are now immersed in the paraffin-wax, withdrawn, and placed on a horizontal heated iron slab; a sheet of tinfoil is now placed on these papers, with its lug projecting beyond the paper, and to the left-hand side. Two sheets of paper are now immersed in the wax and laid over the tinfoil; another sheet of tinfoil is now taken and placed on the paper with its lug projecting to the right-hand side. Two more sheets of paper are next laid on, and then another sheet of tinfoil, and this process is carried on till the condenser has been made the desired size. The condenser is now placed between two heated iron plates, and a weight placed on them to squeeze out the superfluous paraffin, and the whole left till it becomes dry and hard. When finished,

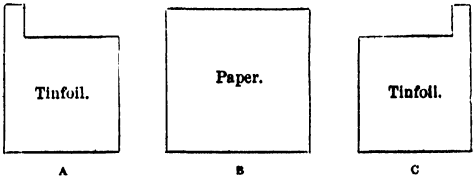

Fig. 62.

the lugs of one set of alternate plates are all turned to one side, and the lugs of the others to the other side, as shown in Fig. 63. These lugs are then soldered together with soft solder—in some cases the soldering is done before the condenser is built up. The tinfoil plates are usually made of the size 7¼ × 6 inches, and a condenser containing 37 such plates has a capacity of about one microfarad. There is always an odd number of plates in a condenser, so that the outside plates are both connected to the same terminal. It will be noticed that by this arrangement *both sides* of each plate are utilised, with the exception of the exterior plates, in which only one side is used. During the construction care must be taken that the temperature of the paraffin-wax does not rise, otherwise it will be partially decomposed and its insulating properties considerably diminished. Even at a temperature of 110° Cent. some decomposition occurs, but it is so slight as not to interfere with its insulating properties; it is, however, well not to use the same paraffin on two different occasions, it is false economy. When completed, the capacity must usually be adjusted to some fixed amount; and in order to do this, it is tested by comparison with a standard condenser. If its capacity is too high, a portion of a plate of tinfoil is removed, and again tested, till its capacity is right. If it is too low, it may be reheated and squeezed under a heavier weight in order to bring the plates closer together, or it may be adjusted by adding a little tinfoil to one of the outside sheets.

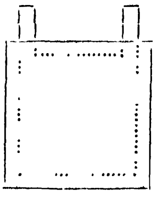

Fig. 63.

LATIN.—XXXII.

[*Continued from p.* 65.]

THE AGRICOLA OF TACITUS (*continued*).

The Inhabitants of Britain.

11. Ceterum Britanniam qui mortales initio coluerint, indigenae an advecti, ut inter barbaros, parum compertum. Habitus corporum varii atque ex eo argumenta. Namque rutilae Caledoniam habitantium comae, magni artus Germanicam originem adseverant. Silurum colorati vultus, torti plerumque crines, et posita contra Hispania Hiberos veteres trajecisse easque sedes occupasse fidem faciunt. Proximi Gallis et similes sunt, seu durante originis vi, seu procurrentibus in diversa terris positio caeli corporibus habitum dedit. In universum tamen aestimanti Gallos vicinam insulam occupasse credibile est. Eorum sacra deprehendas, superstitionum persuasiones. Sermo haud multum diversus; in deposcendis periculis eadem audacia et, ubi advenere, in detrectandis eadem formido. Plus tamen ferociae Britanni praeferunt, ut quos nondum longa pax emollierit. Nam Gallos quoque in bellis floruisse accepimus; mox segnitia cum otio intravit, amissa virtute pariter ac libertate. Quod Britannorum olim victis evenit: ceteri manent, quales Galli fuerunt.

Military Organisation of Britain—Its Climate and Products.

12. In pedite robur; quaedam nationes et curru proeliantur. Honestior auriga, clientes propugnant. Olim regibus parebant, nunc per principes factionibus et studiis distrahuntur. Nec aliud adversus validissimas gentes pro nobis utilius quam quod in commune non consulunt. Rarus duabus tribusve civitatibus ad propulsandum commune periculum conventus. Ita singuli pugnant, universi vincuntur. Caelum crebris imbribus ac nebulis foedum; asperitas frigorum abest. Dierum spatia ultra nostri orbis mensuram; nox clara et extrema Britanniae parte brevis, ut finem atque initium lucis exiguo discrimine internoscas. Quod si nubes non officiant, aspici per noctem solis fulgorem, nec occidere et exsurgere, sed transire adfirmant. Scilicet extrema et plana terrarum humili umbra non erigunt tenebras, infraque caelum et sidera nox cadit. Solum praeter oleam vitemque et cetera calidioribus terris oriri sueta patiens frugum, fecundum: tarde mitescunt, cito proveniunt; eademque utriusque rei causa, multus humor terrarum caelique. Fert Britannia aurum et argentum et alia metalla, pretium victoriae. Gignit et Oceanus margarita, sed subfusca ac liventia. Quidam artem abesse legentibus arbitrantur; nam in rubro mari viva ac spirantia saxis avelli, in Britannia, prout expulsa sint, colligi. Ego facilius crediderim naturam margaritis deesse quam nobis avaritiam.

The Roman Rule in Britain.

13. Ipsi Britanni dilectum ac tributa et injuncta imperii munera impigre obeunt, si injuriae absint. Has aegre tolerant, jam domiti ut pareant, nondum ut serviant. Igitur primus omnium Romanorum divus Julius cum exercitu Britanniam ingressus, quamquam prospera pugna terruerit incolas ac litore potitus sit, potest videri ostendisse posteris, non tradidisse. Mox bella civilia et in rem publicam versa principum arma, ac longa oblivio Britanniae

etiam in pace: consilium id divus Augustus vocabat, Tiberius praeceptum. Agitasse Gaium Caesarem de intranda Britannia satis constat, ni velox ingenio mobili paenitentiae, et ingentes adversus Germaniam conatus frustra fuissent. Divus Claudius auctor iterati operis, transvectis legionibus auxiliisque et adsumpto in partem rerum Vespasiano, quod initium venturae mox fortunae fuit: domitae gentes, capti reges et monstratus fatis Vespasianus.

14. Consularium primus Aulus Plautius praepositus ac subinde Ostorius Scapula, uterque bello egregius: redactaque paulatim in formam provinciae proxima pars Britanniae; addita insuper veteranorum colonia. Quaedam civitates Cogidumno regi donatae (is ad nostram usque memoriam fidissimus mansit), vetere ac jam pridem recepta populi Romani consuetudine, ut haberet instrumenta servitutis et reges. Mox Didius Gallus parta a prioribus continuit, paucis admodum castellis in ulteriora promotis, per quae fama aucti officii quaereretur. Didium Veranius excepit, isque intra annum extinctus est. Suetonius hinc Paulinus biennio prosperas res habuit, subactis nationibus firmatisque praesidiis; quorum fiducia Monam insulam ut vires rebellibus ministrantem adgressus terga occasioni patefecit.

The Spirit of Revolt in Britain.

15. Namque absentia legati remoto metu Britanni agitare inter se mala servitutis, conferre injurias et interpretando accendere: nihil profici patientia nisi ut graviora tamquam ex facili tolerantibus imperentur. Singulos sibi olim reges fuisse, nunc binos imponi, e quibus legatus in sanguinem, procurator in bona saeviret. Aeque discordiam praepositorum, aeque concordiam subjectis exitiosam. Alterius manum centuriones, alterius servos vim et contumelias miscere. Nihil jam cupiditati, nihil libidini exceptum. In proelio fortiorem esse qui spoliet: nunc ab ignavis plerumque et imbellibus eripi domos, abstrahi liberos, injungi dilectus, tamquam mori tantum pro patria nescientibus. Quantulum enim transisse militum, si sese Britanni numerarent? Sic Germanias excussisse jugum: et flumine, non Oceano defendi. Sibi patriam conjuges parentes, illis avaritiam et luxuriam causas belli esse. Recessuros, ut divus Julius recessisset, modo virtutem maiorum suorum aemularentur. Neve proelii unius aut alterius eventu pavescerent: plus impetus, majorem constantiam penes miseros esse. Jam Britannorum etiam deos misereri, qui Romanum ducem absentem, qui relegatum in alia insula exercitum detinerent; jam ipsos, quod difficillimum fuerit, deliberare. Porro in ejus modi consiliis periculosius esse deprehendi quam audere.

NOTES TO TACITUS.

Chap. XI.—*Ut inter barbaros.* "As you would expect among savages."

Habitus corporum. "The physical types."

Rutilae Caledoniam habitantium comas. This is a direct refutation to those who hold that everybody born north of the Tweed must be a black Celt.

Colorati, i.e., "dark.

Posita contra Hispania. The subjects of the verb *faciunt* are curiously assorted. These words must be rendered: "the fact that Spain is situate opposite to them."

Caeli positio. "The quarter of the heavens," or, in other words, "the climate."

In universum aestimanti. The dative case is an agreement with *mihi*, which may be inferred. Translate: "Taking a broad view, I find it credible," etc.

Eorum sacra. The sense of the passage is "the sacred rites and superstitions of the Britons are the same as those of the Gauls."

Deprehendas. Second singular of the present subjunctive. It is used impersonally as we use "you," and the French use "*on.*"

Sermo haud multum diversus. The languages spoken by Britons and Gauls, which did not differ greatly, were dialects of Celtic.

Chap. XII.—*Honestior auriga.* The practice of the early Britons differed from that of most nations who have fought from a chariot: "The charioteer is the man of noble birth, while the dependants fight (from the chariot)."

Nunc per principes, etc. "Now they are divided through the action of chieftains, by faction and intrigue."

Rarus duabus . . . conventus. The English idiom differs wholly from the Latin. We should make the *states* the nominative, and translate thus: "Two or three states seldom combine together to ward off a common danger."

Caelum, etc. The climate has altered little since the time of Tacitus. Then, as now, the sky was darkened by mist and cloud, so that all the sins of the fog may not be ascribed to coal-gas.

Scilicet extrema, etc. This explanation of the northern twilight is of course baseless. Tacitus believed that the earth was flat, and that the night was the result of the shadow cast by the earth.

Chap. XIII.—*Ipsi.* Tacitus has just been speaking of the country and its products, and naturally introduces the mention of the inhabitants with *ipsi*.

Injuncta imperii munera. Lit., "the enjoined services of the Empire," or, as we should say, "the services enjoined by the Empire."

Si injuriae absint. The character which Tacitus gives the ancient Britons belongs to those who inhabit the land to-day, in spite of the introduction of fresh blood. Now, as then, they are ready to obey if they are protected from oppression (*injuriae*); now, as then, they consent to be ruled (*pareant*), but will not endure slavery.

Igitur. The conjunction does not here imply a consequence or result. It simply marks a transition from one subject to another. It may be translated, "to continue," or, "to resume."

Divus Julius. The great Julius Cæsar was the first to enter Britain with an army, and he has left us the history of his campaigns.

Potitus sit. From *potior*, which, as you have learnt, is followed by an ablative.

Potest videri. "May be regarded."

Ostendisse posteris, etc. A very concise method of stating the proposition, "To have pointed out the way to posterity, rather than to have handed over the country already conquered."

Mox. "Then came."

Bella civilia. Civil wars in Rome, not in Britain.

Ni velox ingenio. This sentence is obscure and compressed. With *velox*, "fuisset" must be understood; *velox paenitentiae* must be construed together, "quick of repentance," or, "quick to repent"; while *ingenio mobili* is the ablative of cause, "on account of his changeable disposition."

Fatis. This is a dative, and the sentiment is strangely hyperbolic: "Vespasian was pointed out to fate."

Chap. XIV.—*Egregius.* Here used in its etymological sense, "above the herd." Translate: "both distinguished soldiers."

Proxima. That part of Britain nearest the invader's point of attack, *i.e.*, the east coast.

Colonia veteranorum. This colony was Camalodunum, now known as Colchester.

Ut haberet, etc. "By which it employs even kings as the instruments of rule."

Parta a prioribus continuit. "Confirmed the acquisitions of his precedessors."

Quorum fiducia. Translate, "on the strength of which."

Mona. "The Isle of Anglesea is meant."

Chap. XV.—*Agitare, conferre*, etc. These are instances of the historical infinitive.

Nihil profici . . . . to the end of the chapter. This passage forms the substance of the Britons' complaint, and is therefore constructed according to the rules of *oratio obliqua*, to which you must turn back if you would understand the passage.

Interpretando. This means, "by interpreting," or, "explaining the reason *of*," their subjection. Messrs. Church and Brodripp translate it, "by discussing."

Ex facili. This is a Greek construction, and not in accord with the rules of Latin grammar. It is equivalent to the adverb.

Singulos, etc. The Britons complain that in the place of one king who once ruled them, the Romans had set two, the legate and the procurator, of which the one passed sentence upon them, the other exacted money

Manum. "The staff of the one"; *centuriones* is in apposition to *manum*.

In proelio. The case of the Britons is indeed hard. In wars they argue, it is the strong man that gets the plunder. But they who are more powerful than the Romans suffer injuries at the hands of weaklings.

Illis. "The other side," *i.e.*, the Romans.

Aemularentur. In *oratio recta* this would be in the first person, as it refers to the speakers: "if only we rivalled."

Pavescerent. This would be the imperative in *oratio recta*: "Let us not give way to panic."

KEY TO TACITUS (*continued*).

5. A.D. 59-62. The first rudiments of war he learnt in Britain under that prudent and vigilant commander Suetonius Paulinus, by whom he was chosen and distinguished as his companion. Neither did Agricola behave recklessly, after the manner of young men who turn warfare into riot; nor did he indolently avail himself of the office of a Tribune and his lack of skill to obtain pleasure and absence from duty, but to know the province, to be known to the army, to learn of such as had experience, to follow such as were worthy and brave, to seek no exploits for ostentation, to avoid none through fear, and in all his pursuits was equally zealous and active. Indeed at no time had Britain been more excited or in a more precarious state. Our veterans were slaughtered, our colonies burned down, our armies surprised and captured. Then it was a struggle for existence, soon after it was a struggle for mastery. Now, though all these affairs were transacted by the counsels and conduct of another, and though the stress of the whole, with the glory of recovering the province, fell to the lot of the general, yet skill, experience, and ambition were acquired by the youth; and there seized his soul a passion for military glory, a spirit distasteful to the times, when of eminent men a malignant opinion was entertained, and when as much peril arose from great repute as from bad.

6. Departing hence to Rome for the discharge of public offices, he married Domitia Decidiana, a lady of distinguished lineage; and to him, who was aspiring to higher honours, this marriage proved a great distinction and support. They lived in marvellous unanimity, through mutual tenderness, and by preferring each other to themselves; however, the praise of a good wife is greater in proportion to the censure of a bad. His lot as Quæstor fell upon Asia, where he had Salvius Titianus for Proconsul. But neither the province nor the Proconsul corrupted his probity, though the country was very rich, nay, ready as a prey for the corrupt; and Titianus, a man bent upon all kinds of rapine, was anxious to purchase by every sort of indulgence a reciprocal concealment. In Asia he was enriched by the birth of a daughter, to be his consolation and support; for the son born to him before, he very soon lost. The interval between his bearing the office of Quæstor and that of Tribune of the People, and even the year of his Tribuneship, he spent in repose and inactivity; for he knew the dangers of the times under Nero, when sloth and heaviness passed for wisdom. With the like indolence he held the Prætorship; for judicial duties had not fallen to his lot. The games and the vain display of the office he arranged according to the mean between moderation and abundance, keeping clear of profusion, but winning repute. As he was next appointed by Galba to examine the offerings of the temples, he carried out the inquiry with so great care, that the only loss which could not be recovered was that caused by Nero's sacrilege.

7. In the following year he suffered a grievous blow in his spirit and family. For Otho's fleet, while cruising for plunder, ravaged Intemelium* (a part of Liguria), slew the mother of Agricola upon her estate, and plundered the estate itself with a great part of her treasure, which had indeed been the cause of the murder. As he therefore went from Rome to solemnise her funeral, he was overtaken by the news that Vespasian had assumed the Empire, and instantly espoused his party. The first steps of his reign and the government of the city were ordered by Mucianus; for Domitian was yet extremely young, and in the fortune of his father found only a licence for debauchery. Mucianus, who had despatched Agricola to levy forces, and found him to have acted in that trust with uprightness and magnanimity, preferred him to the command of the twentieth legion, that had been tardy in taking the oath, as soon as he was informed that he who commanded it before was engaged in seditious practices. It was grown difficult and even formidable to the commander-in-chief, and the

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* Vintimiglia.

prætorian legate was powerless to control them, whether from the temper of the man or from that of the soldiers. Thus Agricola was chosen, at once to succeed, and to punish; and exercising moderation altogether rare, would rather have it thought that he had found them well behaved than made them so.

8. Britain was then under the rule of Vettius Bolanus, who governed more mildly than befitted so high-spirited a province. Hence Agricola restrained his own energy, and held within bounds the ardour of his spirit, as he was well skilled how to show his obedience, and had thoroughly learnt to blend what was honourable with what was profitable. Soon after this, Britain received as its governor Petilius Cerialis, one of consular rank. Agricola's worth had now space for display. But with him at first Cerialis shared only the dangers and fatigues: with him anon he likewise shared the glory; frequently, for trial of his prowess, he committed to his conduct a part of the army; sometimes, from the result of the experiment, set him at the head of forces still larger. Nor did Agricola ever vaunt his exploits to blazon his own fame. To his general and leader, he, as his instrument, still ascribed his good fortune. Thus from his bravery in the execution of his orders, from his modesty in recounting his deeds of bravery, he escaped envy, yet failed not to gain glory.

9. While he was on his way back from commanding a legion, the divine Vespasian raised him to the rank of a patrician, and afterwards he was made governor of the province of Aquitaine, a brilliant appointment, and given both on account of its duties and from the prospect of the Consulship, to which that prince had destined him. There are many who believe, that to military men, subtlety of spirit is wanting, because military jurisdiction is summary and clumsy, and deciding many points by force, does not call for the shrewdness of the forum. Yet Agricola, assisted by his natural prudence, though engaged only with civilians, acquitted himself with facility and uprightness. He carefully distinguished the seasons of business and of recess. Whenever the assizes or tribunals of justice demanded, he was grave, attentive, severe, yet often compassionate. The moment he had fulfilled the duties of his office, he no longer wore the mask of power; he had then put off sternness, airs of State, and greed. Nay, what is very rarely to be seen, his complaisance neither weakened his authority, nor did his severity make him less amiable. It were an injury to the virtues of so great a man to particularise his just dealings, his temperance, and the cleanness of his hands. Glory itself, to which even good men often give way, he did not pursue by any ostentation of bravery, nor by artifice. Thus he was far from maintaining any competition with his colleagues, far from any contest with the Procurators; for he judged it to be no glory to conquer; and to be worsted by them were disgrace. His administration here lasted hardly three years ere he was recalled to the prospect of the consulship. Public opinion was with him, that for his province Britain would be assigned him, from no words of his about it, but because he was deemed equal to the responsibility. Common fame does not always err; sometimes it even directs the public choice. To myself yet very young, whilst he was Consul, he betrothed his daughter, a young lady even then of excellent hopes, and, at the end of his consulship, gave her in marriage. He was then forthwith promoted to the government of Britain, as also invested with the honour of the pontificate.

10. I do not present an account of the situation and people of Britain, a subject about which many authors have written, to pit my accuracy and intelligence against theirs, but only because the country was then first thoroughly subdued. So that such matters as former writers have, without knowing them, embellished with eloquence, will by me be recounted according to the truth. Of all the islands which Roman geography comprises, Britain is the largest. In extent of position it faces Germany to the east, Spain to the west. To the south it looks towards Gaul. Its northern shore, beyond which there is no land, is beaten by a sea vast and boundless. Britain is by Livy and Fabius Rusticus, the former the most eloquent of the ancient historians, the latter of the moderns, compared in shape to a rhomboid, or a battle-axe. And such in effect is its figure on this side of Caledonia, whence common opinion has thus also fashioned the whole. But a tract of territory huge and immeasurable stretches forward to the uttermost shore, and straitening by degrees, terminates like a wedge. Round the coast of this sea, which beyond it has no land, the Roman fleet now first sailed, and thereby proved Britain to be an island, as also discovered and subdued the Isles of Orkney, till then unknown. Thule was only seen from afar, as the order was to sail so far and no farther, as the winter was approaching. This sea they report to be slow and stagnant, difficult to the rowers, and indeed hardly to be raised by the force of winds. This I conjecture to be because land and mountains, which are the cause and materials of tempests, very rarely occur, and because a mighty mass of unbroken water is not easily agitated. An inquiry into the nature of the ocean and of the tide is not the purpose of this work, and about it many have written. One thing I would add, that the sea has nowhere a wider sway, many currents are carried hither and thither, nor is its flux and ebbings confined to the banks and shore; but it works and winds itself far into the country, forms bays in rocks and mountains, as if the same were its native bed.

CHEMISTRY.—XVIII.

[*Continued from p.* 70.]

OLEIC ACID, OLIVE OIL, NON-DRYING AND DRYING OIL; THE CARBOHYDRATES: THE SUGARS, THE THREE SACCHARINS; STARCH, DEXTRIN, CELLULOSE, PARCHMENT PAPER, GUN COTTON, COLLODION; AROMATIC BODIES, BENZENE, ANILIN, ANILIN DYES, CARBOLIC ACID, PICRIC ACID, HYDROQUINONE, PYROGALLIC ACID, BITTER ALMOND OIL, GALLIC ACID, TANNIC ACID, THE TERPENES; THE ALKALOIDS; CONCLUSION.

Oleic Acid ($C_{18}H_{34}O_2$) exists as its propenyl compound known as "olein," or propenyl trioleate $C_3H_5(C_{18}H_{33}O_2)_3$ in most fats, and especially in olive oil and almond oil.

Olive oil and many other vegetable oils when exposed to the air turn rancid, and are converted into viscid substances which have an acid reaction; these are termed "non-drying oils." The oils obtained from linseed, poppy, hemp, walnut, etc., which are known as "drying oils," dry up completely into a sort of elastic varnish.

THE CARBOHYDRATES.

This important class of bodies derives its name from the fact that they all contain in their molecules hydrogen and oxygen in the ratio in which they exist in water, *i.e.*, twice as many atoms of hydrogen as of oxygen. They are divided into three great groups:—(1) Saccharoses ($C_{12}H_{22}O_{11}$), as cane sugar, milk sugar, maltose, etc.; (2) Glucoses ($C_6H_{12}O_6$), as grape sugar or dextrose, fruit sugar or laevulose, etc.; (3) Amyloses or starches ($C_6H_{10}O_5$), as starch, dextrin, glycogen, cellulose, gum, etc.

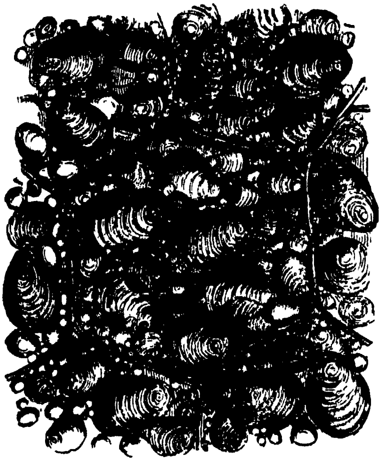


Fig. 51.—POTATO-STARCH GRANULES.

The above formulæ simply give the ratios of carbon, hydrogen, and oxygen, and do not represent the *molecules* of the substances.

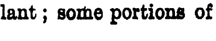
Cane Sugar, or *Saccharose* ($C_{12}H_{22}O_{11}$), is obtained from the juice of the sugar-cane, a variety of beetroot known as the sugar-beet, the date, the sugar maple, etc. When boiled with dilute sulphuric acid, cane sugar is converted into "invert" sugar. Cold strong sulphuric acid instantly chars sugar, converting it into a voluminous black mass of carbon. When heated with nitric acid, sugar is converted into saccharic acid, $C_6H_{10}O_8$. Cane sugar does not reduce an alkaline solution of copper sulphate when the mixture is boiled for a short time. A solution of cane sugar does not ferment directly when yeast is added, but it is rapidly converted by that substance into a mixture of dextrose and lævulose, and these bodies then enter into active fermentation.

Milk Sugar, or *Lactose* ($C_{12}H_{22}O_{11}H_2O$), is obtained from the whey of curdled milk by evaporation; it forms hard white crystals with a sweet taste, and ferments with great difficulty on the addition of yeast.

Maltose ($C_{12}H_{22}O_{11}H_2O$) is the sugar produced by the action of diastase upon starch, and occurs in malt; it is therefore the sugar from which at one time beer was exclusively made. Maltose reduces an alkaline solution of copper sulphate, giving a red precipitate of cuprous oxide, Cu_2O.

The Glucoses.—*Glucose*, *Dextrose*, or *Grape Sugar* ($C_6H_{12}O_6$) occurs in the juice of sweet grapes, and in the urine of persons suffering from diabetes. It is most usually prepared by boiling starch with dilute sulphuric acid for some time; it is much less sweet than cane sugar, and does not crystallise so readily. Cold strong sulphuric acid does not char glucose. Glucose is most readily distinguished from cane sugar by its reducing action on metallic oxides: a small quantity of a dilute solution of copper sulphate is placed in a test tube and mixed with a solution of glucose; caustic potash, KHO, is then added drop by drop until a clear dark-blue solution is obtained; this is heated, when a bulky precipitate, first yellow, $Cu_2(HO)_2$, then red, Cu_2O, is thrown down, and the blue colour completely disappears.

Lævulose closely resembles dextrose, it occurs in honey and many fruits; a mixture of laevulose and dextrose is called fruit or invert sugar. If cane sugar be heated with dilute sulphuric acid, it is converted into invert sugar.

Dextrose, obtained by heating starch with dilute sulphuric acid, and invert sugar, obtained by heating molasses with dilute sulphuric acid, are now manufactured on an enormous scale, and sold as "saccharin," which is used as a substitute for malt in brewing beer. There are two other substances named saccharin, one is the anhydride, $C_6H_{10}O_5$, of monobasic saccharic acid, the other is a substance many times sweeter than ordinary sugar, with which it has no chemical relation whatever; its full name is *benzoylorthosulphonic imide*  $C_6H_4{<}\substack{CO\\SO_2}{>}NH$.

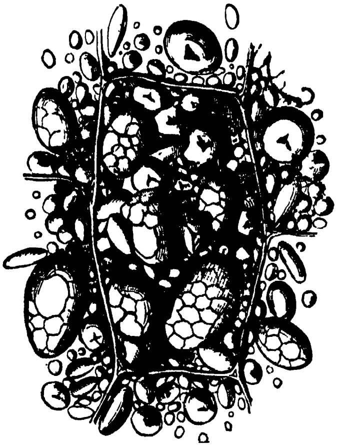


Fig. 52.—MAIZE-STARCH GRANULES.

Starch ($C_6H_{10}O_5$) is very widely diffused, being found in almost every plant; some portions of the plant, as the tuber of the potato, and many seeds, consisting almost entirely of starch. The starch is obtained by grinding or rasping these structures with water, and washing the pulp on a sieve. The milky fluid which passes through contains the starch granules suspended in water; it is allowed to stand, when the starch gradually settles; the water is then drawn off and the starch dried. Starch is insoluble in cold water; when viewed under the microscope the starch granules are found to have characteristic shapes, according to the plant from which they are derived. Concentric lines are usually noticed, which seem to be arranged round one spot called the "hilum," this is well seen in potato starch (Fig. 51). If a mixture of starch and water be boiled, the granules seem to burst, and the starch enters into a sort of solution. When a solution of iodine in potassium iodide is added to cold starch solution, a deep blue colour is produced, which vanishes when the mixture is boiled, but usually returns again on cooling.

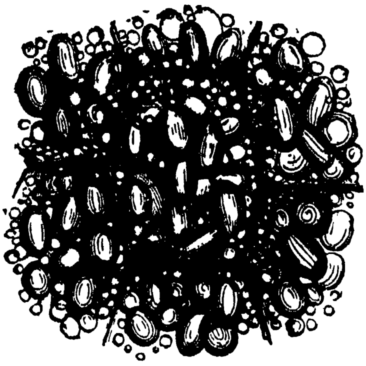


Fig. 53.—Wheat-Starch Granules.

Dextrin, or British gum ($C_6H_{10}O_5$), is prepared by boiling starch with dilute sulphuric acid, or by heating starch to 250° Cent.; if the starch be moistened with nitric or hydrochloric acid, a temperature of 120° Cent. is sufficient: dextrin is also produced by the action of diastase on starch, maltose being simultaneously formed. Dextrin is a white or yellowish-white powder, easily soluble in water, yielding a clear solution, which forms an adhesive liquid giving a red colour with iodine.

Cellulose ($C_6H_{10}O_5$) forms the bulk of the tissues of wood and similar plant structures; in most cases it is rendered very impure by the presence of other substances, *e.g.*, colouring matters, encrusting substances, etc. The purest form of cellulose is found in linen, cotton, and cotton wool; it is tasteless, and quite insoluble in water and alcohol, but it dissolves in an ammoniacal solution of cupric oxide. By the long continued action of sulphuric acid, cellulose is transformed into glucose.

If unsized paper (made from linen rags) be dipped for a few seconds in a cold mixture of two volumes of sulphuric acid with one of water, and then rapidly and thoroughly washed, it is converted into "parchment paper," so largely used for covering jam pots, packing butter, etc.; it can also be used instead of a bladder for experiments on diffusion.

If finely divided cotton wool be soaked in a cold mixture of one part of strong nitric and three parts of strong sulphuric acid, and then thoroughly washed and carefully dried, it forms *guncotton*, or *pyroxylin*, $C_6H_7(NO_2)_3O_5$, three atoms of hydrogen being replaced by three NO_2 groups. Guncotton is much used as an explosive; if lighted it burns rapidly without exploding, but if detonated with a percussion cap it explodes with great violence. It explodes equally well even if soaked in water, provided that there is a small quantity of dry guncotton surrounding the percussion fuse. If the acids in which the cotton wool is soaked are more dilute, *collodion* $C_6H_8(NO_2)_2O_5$ is formed instead of guncotton. Collodion is soluble in a mixture of ether and alcohol, the solution when allowed to evaporate leaves a tough, tenacious, transparent film; it is much used in photography, also in surgery to form a temporary covering for large wounds, burns, etc.

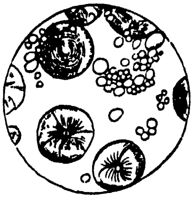


Fig 54.—Rye-Starch.

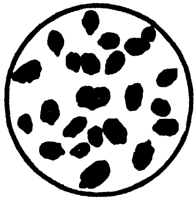
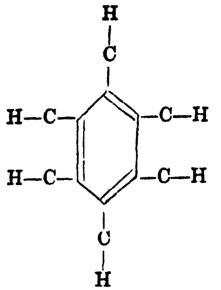


Fig. 55.—Arrowroot-Starch (East India).

THE AROMATIC BODIES.

These may be considered as derivatives of *benzene*. The substances which we have hitherto studied have been chiefly those which are closely connected with the fatty series of hydrocarbons, acids, etc. In all aromatic bodies we find the nucleus C_6H_6, or benzene; it will be noticed that this substance contains a larger number of carbon atoms (compared to the hydrogen) than the hydrocarbons of the fatty series. The constitution of benzene is usually represented by the ring formula, in which the carbon atoms are conveniently arranged in the form of a hexagon, and are united together by one and two bonds alternately, carbon being a tetravalent element (*see* Vol. IV., p. 324):—



From benzene all the aromatic hydrocarbons can be derived, thus toluene is methyl benzene, $C_6H_5(CH_3)$; xylene, dimethyl benzene, $C_6H_4(CH_3)_2$.

Benzene (C_6H_6), sometimes called benzol, can be formed by heating acetylene to a red heat. It is usually obtained from coal-tar oil—*i.e.*, the liquid which distils over when coal is heated for making gas. The oil is purified by repeated washings alternately with sulphuric acid and caustic potash, and is then distilled; the portion which comes over between 80° to 90° is collected apart, and cooled to -12° Cent., when the benzene crystallises out. At ordinary temperatures it is a thin colourless liquid, with pleasant odour; specific gravity ·885, boils at 80·5° Cent. It is insoluble in water, but mixes readily with alcohol and ether. It dissolves iodine, sulphur, phosphorus, and the fats readily. It must not be confounded with the so-called "benzolin," which has similar solvent properties, but is a light paraffin (*see* Vol. VI., p. 4).

Benzene forms (like methane, ethane, etc.) various halogen derivatives, in which chlorine, bromine, and iodine take the place of the hydrogen; thus, we have monochlorbenzene, C_6H_5Cl, dichlorbenzene, $C_6H_4Cl_2$, until we reach C_6Cl_6 (hexchlorbenzene). So, also, we have—

Nitrobenzene ($C_6H_5NO_2$), a light-yellow poisonous liquid, obtained by adding benzene to strong nitric acid. It has an odour resembling that of bitter-almond oil. It is used for flavouring confectionery, scenting soap, etc., under the name of "Essence of Mirbane," or artificial bitter-almond oil. Enormous quantities have been used, of late years, for the manufacture of anilin.

Anilin, or *Amidobenzene* ($C_6H_5NH_2$).—This base—for it can be considered as ammonia, NH_3, in which one H has been replaced by phenyl, C_6H_5—was first obtained in 1826, as a product of the distillation of indigo. It is usually manufactured by reducing nitrobenzene with nascent hydrogen; iron-filings and hydrochloric acid being used to generate the hydrogen—

$$C_6H_5NO_2 + 3Fe + 6HCl = C_6H_5NH_2 + 3FeCl_2 + 2H_2O.$$

Anilin is a colourless liquid, with a peculiar odour; specific gravity 1·036, boils at 184·5° Cent. When quite pure, it solidifies at -8° Cent.; when exposed to the air, it turns brown; it is not very soluble in water, but dissolves readily in alcohol and ether. When bleaching powder (chloride of lime) is added to a solution of anilin in water, a violet colour is produced. Both anilin and its vapour are very poisonous. Enormous quantities are manufactured, and used in the production of the well known anilin dyes.

In 1856, Perkin commenced an investigation on the artificial formation of quinine. His experiments in this direction were unsuccessful; but, by treating the sulphate of anilin with potassium bichromate, he obtained what he described as a very unpromising precipitate, and extracted from it the now well known dye, *Mauve*. This, the first anilin dye, was discovered about Easter 1856; and although it has been driven out of commerce by other more brilliant dyestuffs (it is still used in this country to colour the penny stamp), yet the importance of its discovery can hardly be over-estimated. Mauve was eventually proved to be the sulphate of a powerful organic base, $C_{27}H_{24}N_4$.

In 1858, another important colouring matter was prepared—*Anilin Red*, or *Rosanilin* ($C_{20}H_{21}N_3O$). Various salts, acetate, hydrochloride, etc., occur in commerce under the names of magenta, fuchsine, etc. Colours of all shades are now prepared from the parent substance, anilin, and bodies closely allied to it; but their constitution is usually complicated, and their methods of preparation only interesting to the chemist and the manufacturer

Phenyl Alcohol, Carbolic Acid, Phenol, Coal-tar Creosote (C_6H_5HO).—This substance may be considered as benzene in which one H is replaced by the group HO. It is an important constituent of coal-tar oil, in which it was discovered in 1834. The oil is distilled, and the portion which passes over between 150° to 200° Cent. collected. This portion is treated with caustic soda solution, the lower layer of liquid drawn off and decomposed by adding dilute sulphuric acid. The crude product thus obtained is purified by distillation.

Pure phenol crystallises in colourless needle-shaped crystals; specific gravity 1·066, melting at 40° Cent., and boiling at 181·5° Cent. On keeping it usually turns a reddish colour. Its odour is well known. It is very poisonous, and attacks the skin; the best antidote is either half a tumbler of olive oil, or half an ounce of Epsom salts dissolved in warm water. Carbolic acid is a powerful disinfectant; it dissolves in about 15 parts of water, and is readily soluble in alcohol. The aqueous solution is coloured violet on the addition of a little ferric chloride.

Phenol or carbolic acid must not be confounded with the creosote obtained by distilling beech and other hard woods. This wood-tar creosote contains, it is true, some phenol; but it contains, in addition. creosol ($C_6H_3CH_3OCH_3OH$) and some allied bodies, which together give it its characteristic odour. This creosote is much used for preserving wood, fish ("kippering)," etc. The coal-tar creosote does not contain any creosol, etc

By the action of strong nitric acid, phenol is converted into a nitro body, called—

Picric Acid, $C_6H_2(NO_2)_3HO$.—This substance forms yellow crystals, which have an intensely bitter taste; they are slightly soluble in water, but more readily in alcohol. The solution stains the skin and dyes wool and silk a bright yellow. Its salts, the picrates, explode violently when heated. One of the varieties of smokeless powder contains much picric acid.

Quinone ($C_6H_4O_2$) is a yellow crystalline substance, obtained by oxidising anilin with dilute chromic acid, H_2CrO_4; when sulphur dioxide, SO_2, is passed into an aqueous solution of quinone, it is converted into—

Hydroquinone, or *Quinol*, $C_6H_4(HO_2)$.—This substance forms colourless prisms; melting at 169° Cent., soluble in 17 parts of water, and easily in alcohol and ether. It reduces silver salts, and has been much used during the past two or three years as a photographic "developer."

Pyrogallic Acid, $C_6H_3(HO)_3$—or, as it is more properly termed, *Pyrogallol* (since it is an alcohol, not an acid)—is obtained by heating gallic acid—

$$\underbrace{C_7H_6O_5}_{\text{Gallic acid.}} = CO_2 + \underbrace{C_6H_6O_3}_{\text{Pyrogallol.}}$$

It can be prepared by heating the dried residue obtained by evaporating an aqueous extract of gallnuts, to 180–185° Cent., in an iron saucepan, covered with a paper hood. It forms colourless crystals, which are very light and very soluble in water. When an alkali (NaHO, KHO, or AmHO) is added, its aqueous solution rapidly absorbs oxygen from the air, and turns brown; it gives a bluish-black colour with ferrous sulphate, and reduces gold and silver salts. It is a well-known photographic "developer."

Benzoic Aldehyde, or *Bitter Almond Oil* (C_6H_5COH), can be obtained by crushing bitter almonds, adding water, and then allowing the mixture to stand five to six hours at a temperature of 30° to 40° Cent. Bitter almonds contain what is termed a "glucoside" (*i.e.*, a substance which yields grape sugar or glucose when it splits up) named "amygdalin." They also contain a peculiar ferment, "emulsin or synaptase," which has the power of splitting up amygdalin into bitter almond oil, hydrocyanic acid, and glucose. The benzoic aldehyde is then distilled off. It is obvious that this oil will contain the prussic acid. The ordinary bitter almond oil, therefore, is very poisonous. It can be freed from the prussic acid without spoiling its flavouring properties, but the pure oil is said not to keep so well.

Gallic Acid, $C_6H_2(HO)_3COOH$, or $H(C_7H_5O_5)$, occurs in nutgalls, in the leaves of certain oaks, and in sumach. It forms colourless crystals, which are not very soluble in water. Its solutions give a bluish-black colour with ferric salts (ordinary writing-ink)

Tannic Acid, or *Tannin* ($C_{14}H_{10}O_9$), occurs in nutgalls, in sumach, in tea, etc. It can be obtained from powdered nutgalls by extracting with a mixture of spirits of wine and ether; the extract on standing separates into two layers, the lower being a strong solution of tannin. Tannin is readily soluble in water. Its solution gives a blue-black colour with ferric chloride, and precipitates a solution of gelatin. It is to this property of coagulating and precipitating albuminous bodies, etc., that oak-bark, nutgalls, and other substances containing tannin owe their efficacy in the tan-pits; the solution of tannin gradually precipitates and converts the organic portion of the skin into insoluble leather.

The *Terpenes* ($C_{10}H_{16}$) are hydrocarbons which occur in volatile oils—as oil of turpentine, lemons, bergamot, citron, etc., which are found in plants, chiefly coniferous (firs, etc.) or aurantiaceous (orange, lemon, etc.). The constitution of these hydrocarbons has not yet been determined; they all have the same percentage composition, although they differ as regards their physical properties, odour, etc. These oils, which are often called the "essential oils," differ from the fatty oils in leaving a grease stain on paper which is *not* permanent.

Camphor ($C_{10}H_{16}O$) is closely connected with the terpenes.

The essential oils are obtained from the various plants either by pressure or by distillation in a current of steam. Turpentine is prepared by heating the oleo-resinous juice which exudes from incisions in various pines; the turpentine distils over, while "resin" or "colophony" remains behind in the retort.

The Alkaloids are organic bases of vegetable origin. They all contain nitrogen, and are mostly solid; they unite with acids, HCl, H_2SO_4, etc., to form salts; their solution are all precipitated by a solution of iodine in potassium iodide. *Nicotine* is a very poisonous brown liquid obtained from

MONKWEARMOUTH. (*From a Photograph by P. Stabler, Sunderland*)

It is a mere record from year to year of the chief facts of English history, from the invasion of Julius Cæsar, B.C. 55, down to the death of Stephen, in A.D. 1154. The opinion is that so much as relates the history down to the time of Alfred was composed in the reign of that king, and that the chronicle was afterwards continued from time to time, until it finally came to a close at the period we have mentioned.

II. THE PERIOD AFTER THE NORMAN CONQUEST.

The Norman Conquest was the death-blow to all literature among the conquered people. Saxon bishops and abbots gave place to Norman; the richest lands passed to the Normans; every great office of trust and profit was reserved for the Normans. The Saxons were crushed and ground beneath the unflinching tyranny of a people alien in language as in race The "Anglo-Saxon Chronicle," it is true, was still carried on in the abbey of Peterborough; but the people were far too completely prostrate to have heart or energy left for any higher literary effort.

Latin literature, however, received a great impulse from the Conquest, for by it England was brought into closer contact with the continent of Europe. In those days the commonwealth of learning knew no distinction of race or country. In our time every nation has its own favourite courses of study, in which students are taught by their own countrymen, and in their own tongue. But in the days of which we are speaking, there was but one school of learning, and one language for the learned. An English student would have been equally at home at Oxford, at Paris, or at Bologna. In each place he would find the men of the same school teaching the same philosophy, and in the same tongue. Accordingly, long before the Conquest the Saxon Alcuin had taught at the court of Charlemagne; and Scotus Erigena, the Irish philosopher, in France. So now the archbishopric of Canterbury was occupied immediately after the Conquest by two Italians in succession, Lanfranc and Anselm, both of them great theologians and scholars. John Duns Scotus, of Celtic race, and a native either of Scotland or Ireland, taught the scholastic philosophy both at Oxford and in Paris; while the great English schoolmen Alexander Hales and William of Occam taught in France and Germany. Of the English philosophers who lived and taught in England, the most eminent was Friar Roger Bacon, known to fame as the reputed inventor of gunpowder, who pursued the study of natural science with unwearied diligence and remarkable success in the thirteenth century, and acquired thereby, as did many another deep student, the questionable reputation of being a magician.

Poetry in Latin also was cultivated among the learned with considerable success; but most of the productions of this class are of comparatively little interest to us in the present day. There is one class of Latin poems, however, which deserves to be specially noted, not only because it is curious in itself, but still more because it reveals to us much of the thoughts of men at the period; and, moreover, it shows the beginning of a spirit which received its full development in the days of Wiclif. Walter Map, sometimes wrongly called Mapes (the Latin form of his name being Mapus), was a churchman eminent for learning and ability in the reign of Henry II., and held in the reign of Richard I. the office of Archdeacon of Oxford. By him was written a great mass of poetry in rhymed Latin verse, the subject of which was generally the corruptions of the clergy, and which attained immense popularity. The central figure in most of these poems is a certain imaginary bishop "Golias," the representative of idleness, corruption, and sensuality among the clergy. There is the "Vision of Golias," the "Confession of Golias," and a vast number of other poems connected with his name. Most of these compositions are satires of the broadest kind, directed against the clergy, especially the monks, and, above all, the Cistercians; but among them are to be found a good many very serious exhortations and moral discourses as to the obligations of the clerical life, and upon kindred subjects. The remarkable extent and great popularity of this Golias literature are instructive as showing how closely the popular disgust at the growing corruptions of the clergy, and particularly of the monastic orders, was connected with the early development of our literature, a subject upon which we shall have more to say later on.

But the class of Latin writings most especially characteristic of this period are the innumerable chronicles which were produced during it. These chronicles were written by monks in the great monasteries scattered over the kingdom. They are the histories of different periods; some of them purporting to contain the history of the world from the creation, others only the history of England, or even a small portion of it. And they are of very various degrees of merit, some of them being the merest transcripts of earlier writers, while others give us very lifelike pictures of contemporary events. Among the most famous of these chroniclers—famous, some for their truth and others for their falsehood—are William of Malmesbury, Geoffrey of Monmouth, Giraldus Cambrensis, Roger of Hoveden, Matthew Paris, William of Rishanger, and Ralph Higden.

But the Norman conquerors of England were, as a class, no more competent to understand a literature in Latin than the conquered Saxons, and the literary education of even the highest classes was practically nil. They had, therefore, as was natural, a literature of their own in French. In France two dialects, or rather two languages, prevailed. In the south was spoken the Provençal tongue, and in this tongue the *Troubadours* composed and sang their poems. In the north was spoken a different dialect, the ancestor of the modern French, and its poets were the *Trouvères.* Of the works of these latter, the Normans, no doubt, brought many with them from France, and many more came over later, or were composed in England. The poetry of the Trouvères is the poetry of chivalry, the poetry of the Crusaders. It consisted chiefly of romances in verse upon subjects of chivalry, the adventures of King Arthur and the Knights of the Round Table, and those of Charlemagne and his peers, occupying by far the largest space. But the subjects of those romances were very various, though their character is very uniform. There was, besides, a class of stories in verse or prose, founded, not upon the adventures of heroes, but upon the simpler incidents of real life, which were known as *fabliaux.*

We have said that the Norman Conquest was for the time the destruction of the native literature. The "Anglo-Saxon Chronicle," no doubt, was continued for nearly a century longer, down to the end of the reign of Stephen; and there are still extant songs in the native tongue dating from a very early period. But these exceptions are so slight, that it may safely be said that after the Conquest the Saxon tongue soon ceased to be used for literary purposes, its place being taken partly by Latin, and partly by Norman-French.

The period between the death of Stephen and the age of Chaucer, a period of about two hundred years, is commonly divided, as has been already pointed out, into two pretty equal periods, during which the names Transition English and Old English are applied to the language. But we must again remind the student that these divisions are adopted, not to mark any sudden breaks in the development of the language, but because chronological divisions are convenient as aids to the memory in retaining a large number of facts spread over a long time.

During the first of these two periods, the Transition English, we find a tendency to revival in the English language, though the remains that have come down to us are but small in extent. Layamon was a priest of Ernley, on the Severn, probably in the days of Henry II. He wrote a chronicle of Britain under the title of "Brut." The name represented the general, though of course groundless, belief among our ancestors that this island was colonised by one Brutus, of Trojan descent, and after him was called Britain. This chronicle, as the author himself tells us, was founded upon several earlier books in Latin, including the French narrative of Wace. The work of Layamon displays considerable poetical power and originality; and it curiously illustrates the character of the times in which it was written, and the transition that was commencing, by its form; for, alternating with the old Saxon system of alliterative verses, it shows us the rhyming versification borrowed from the Norman-French. In the main, however, its structure is Saxon.

To the same century, though probably a later portion of it, belongs the "Ormulum," so called by its author Orm, or Ormin, after his own name. Ormin was an Augustinian friar, and his book is a metrical version of the Gospel narrative, harmonised, as he explains himself, from the four Evangelists; and with homilies or discourses added upon the various passages, in the order in which they occur in the Church services. The "Ormulum" is very long, and has but little poetical merit; but the versification is smooth, and its form is worth noting. The metre is almost identical with the modern ballad metre, but without rhyme, and also without alliteration.

Other remains of Transition English literature have come down to us, but none of so great general interest as the two of which we have spoken. The largest and most important work of this period which has been published next to those mentioned is the "Ancren Riwle," or "Rule of the Anchoresses" (that is, nuns). This curious book is a treatise on the duties and dangers of nuns, with full instructions for their guidance upon all points, illustrated by warnings and examples from the Bible and other sources. It is addressed, apparently by a learned divine (possibly Bishop Poor, who died in 1237), to three ladies, "sisters, of one father and one mother, having in the bloom of youth forsaken all the pleasures of the world and become anchoresses."

The remaining period, falling between the middle of the thirteenth century and the age of Chaucer, is that during which the name of Old English is given to the language; and in it, as in the preceding period, the literature in the native tongue is but scanty.

The two most ambitious works in English belonging to this period are metrical chronicles, those of Robert of Gloucester, and Robert Mannyng or Robert of Brunne. Neither of these is of much historical merit; neither is much more than a translation from earlier Latin and French authors. They illustrate, however, the increasing demand for the means of historical teaching in the vernacular. The same thing is strongly shown by the increasing number of versions, sometimes in verse, sometimes in prose, of portions of the Holy Scriptures, and other works designed for the purposes of religious instruction.

But the revival of national spirit is manifested more plainly still by the lighter literature of the period. At an earlier date the literature of mere pleasure, as distinguished from that designed for instruction, was all, or nearly all, in French. But at this period, writers were busy turning the most popular of the French romances into English; and, as might be expected, they were not only translated, but imitated, and to such an extent that a considerable quantity of the vernacular poetry of that age has been handed down to us; while, of course, that which we possess must be but a very small part of that which once existed.

Such is in very brief outline the history of literature in England before the great era of which Chaucer is the most distinguished representative.

GREEK.—IX.

[Continued from p. 78.]

COMPARISON OF ADJECTIVES (*continued*).

II. THE SECOND FORM.

	MASC.	FEM.	NEUT.
Comparative.	-ιων		-ιον.
Superlative.	-ιστος	-ιστη	-ιστον.

These forms are taken by ἡδύς, *sweet*, and ταχύς, *swift*, the termination -υς being removed. Ταχύς, however, has in the comparative θάττων (θάσσων is another form of the same word); thus—

Positive.	*Comparative.*	*Superlative.*
ἡδ-ύς.	ἡδ-ίων.	ἥδ-ιστος.
ταχ-ύς.	θάττων.	τάχ-ιστος.

Also by two adjectives ending in -ρος (namely, αἰσχρός, *hateful*, *shameful;* and ἐχθρός, *hostile*), the termination -ρος being cut off; as—

Positive.	*Comparative.*	*Superlative.*
αἰσχρός.	αἰσχ-ίων.	αἴσχ-ιστος.
ἐχθρός.	ἐχθ-ίων.	ἔχθ-ιστος.

VOCABULARY.

Ἄλλοι, -αι, -α, others.

Ζῶον, τὸ, a living being, an animal.

Καιρός, -οῦ, ὁ, season (*time* generally).

Λοιπός, -ή, -όν, the remainder, the rest.

Μεταφέρω, I bear away, change.

Οἱ ἀκρατεῖς, the intemperate.

Ὀσμή, -ῆς, ἡ, smell.

Ὄφις, -εως, ὁ, a serpent.

Παρέχω, I afford, communicate; (middle voice) yield, give.

Πρᾶγμα, -ᾰτος, τὸ, a deed, thing.

• EXERCISE 53.

Translate into English:—

1. Ὁ βαθύτατος ὕπνος ἥδιστός ἐστιν. 2. Πολλὰ ἄνθη ἡδίστην ὀσμὴν παρέχεται. 3. Οὐδὲν θᾶττόν ἐστι τῆς ἥβης. 4. Τὴν αἰσχίστην δουλείαν οἱ ἀκρατεῖς δουλεύουσιν. 5. Πάντων ἥδιστόν ἐστιν ἡ φιλία. 6. Οὐδὲν αἴσχιόν ἐστιν ἢ ἄλλο μὲν ἐν νῷ ἔχειν, ἄλλο δὲ λέγειν. 7. Οἱ ὄφεις τοῖς λοιποῖς ζώοις ἔχθιστοί εἰσιν. 8. Οὐδὲν τῷ ἀνθρώπῳ ἔχθιόν ἐστιν ἢ ὁ ἄνθρωπος. 9. Τάχιστα ὁ καιρὸς μεταφέρει τὰ πράγματα.

EXERCISE 54.

Translate into Greek:—

1. Nothing is sweeter than deep sleep. 2. Sleep is very sweet. 3. Nothing is more disgraceful than slavery. 4. Slavery is a very bitter thing. 5. Horses are very swift. 6. Nothing is more unfriendly than bad advice. 7. It is most shameful to think one thing and say another. 8. Bad men think one thing and say another. 9. Nothing is sweeter than a faithful friend.

A number of adjectives not being reducible to either of these forms, are called irregular (though some, it will be observed, have also the regular form): *e.g.*—

ADJECTIVES OF IRREGULAR COMPARISON.

1. ἀγαθός, good	ἀμείνων, N. ἄμεινον	ἄριστος, -η,	-ον.
	βελτίων	βέλτιστος	,,
	κρείττων (κρείσσων)	κράτιστος	,,
	λῴων	λῷστος	,,
. κακός, bad	κακίων	κάκιστος	,,
	χείρων	χείριστος	,,
	ἥττων (ἥσσων), inferior	[ἥκιστα, *adv.*]	,,
3. καλός, beautiful	καλλίων	κάλλιστος	,,
4. ἀλγεινός, painful	ἀλγεινότερος (*regular*)	ἀλγεινότατος	,,
	ἀλγίων	ἄλγιστος	,,
5. μακρός, long	μακρότερος	μακρότατος	,,
	μάσσων	μήκιστος	,,
6. μικρός, small	μικρότερος	μικρότατος	,,
	ἐλάττων (ἐλάσσων)	ἐλάχιστος	,,
7. ὀλίγος, few	μείων	ὀλίγιστος	,,
8. μέγας, great	μείζων	μέγιστος	,,
9. πολύς, much	πλείων (πλέων)	πλεῖστος	,,
10. ῥᾴδιος, easy	ῥᾴων	ῥᾷστος	,,
11. πέπων, ripe	πεπαίτερος	πεπαίτατος	,,
12. πίων, fat	πιότερος	πιότατος	,,

Several adjectives which express the idea of *order* or *succession* appear in the comparative and superlative only, since from their import they cannot denote an absolute quality, and may be used only in comparison. Their root will be found in a preposition or adverb of *place*. For example:—

ADJECTIVES WITHOUT A POSITIVE.

From πρό, before	πρότερος, prior	πρῶτος, first.
From ἄνω, up	ἀνώτερος, upper	ἀνώτατος, upmost.
From ὑπέρ, over	ὑπέρτερος, higher	ὑπέρτατος, highest.
From ὑπό, under	ὕστερος, posterior	ὕστατος, most behind.
From ἐξ, from		ἔσχατος, last, most from, most remote.
From πλησίον, near (in Homer πλησίος)	πλησιαίτερος, nearer	πλησιαίτατος, nearest.
From πρόσω, forwards	προσώτερος, further, more in advance	προσώτατος, furthest.

Ὡς, with a superlative, adds strength to it, as *quam* in Latin; for example, ὡς τάχιστος, quam celerrimus, *as swift as possible*.

VOCABULARY.

Ἀναγκαῖος, -α, -ον, necessary.
Ἀνάγκη, -ης, ἡ, necessity.
Ἀναρχία, -ας, ἡ, absence of government, anarchy.
Γείτων, -ονος, ὁ, a neighbour.
Ἐλεύθερος, -α, -ον, free.
Ἔμφυτος, -ον, inborn.
Ἐνίοτε, sometimes.
Εὐτυχής, -ες, fortunate.
Ἤ, ἤ, either, or.
Ἰβηρία, -ας, ἡ, Spain.
Ἰσχύω, I am strong.
Κελεύω, I order.
Κολακεία, -ας, ἡ, flattery.
Μαλακός, -ή, -όν, soft.
Μέτρον, -ου, τὸ, measure, moderation.
Σκώπτω, I jeer.
Στέργω, I love, I am satisfied with, I put up with.
Σύμβουλος, -ου, ὁ, an adviser.
Σωφροσύνη, -ης, ἡ, soundmindedness.

EXERCISE 55.

Translate into English:—

1. Οὐχ ὁ μακρότατος βίος ἄριστός ἐστιν, ἀλλὰ ὁ σπουδαιότατος. 2. Μέτρον ἐπὶ πᾶσιν ἄριστον [understand ἐστιν]. 3. Γνῶμαι τῶν γεραιτέρων ἀμείνους εἰσίν. 4. Σύμβουλος οὐδεὶς ἐστι βελτίων χρόνου. 5. Ἢ λέγε σιγῆς κρείττονα, ἢ σιγὴν ἔχε. 6. Ἀεὶ κράτιστόν ἐστι τὸ ἀσφαλέστατον. 7. Σκώπτεις, ὦ λῷστε. 8. Βελτιόνων κακίους ἐνίοτε εὐτυχέστεροί εἰσιν. 9. Οὐκ ἐστὶ λύπης χεῖρον ἀνθρώπῳ κακόν. 10. Κολακεία τῶν ἄλλων ἁπάντων κακῶν χείριστόν ἐστιν. 11. Ἀνὴρ μαλακὸς τὴν ψύχην καὶ χρημάτων ἥττων. 12. Ταῖς γυναιξὶν ἡ σωφροσύνη καλλίστη ἀρετή ἐστιν. 13. Οὐκ ἔστι κτῆμα κάλλιον φίλου. 14. Ἡ δουλεία τῷ ἐλευθέρῳ ἀλγίστη ἐστίν. 15. Ἡ ὁδος μηκίστη ἐστίν. 16. Ὁ κροκόδειλος ἐξ ἐλαχίστου γίγνεται μέγιστος. 17. Ἡ γῆ ἐλάττων ἐστὶ τοῦ ἡλίου. 18. Στέργε καὶ τὰ μείω. 19.

ἄνθρωποι εὐδαίμονές εἰσιν. 20. *Οὐδεὶς νόμος ἰσχύει μεῖζον τῆς ἀνάγκης.* 21. *Μικρὰ κέρδη πολλάκις μείζονας βλάβας φέρει.* 22. *Ἀναρχίας μεῖζον οὐκ ἔστι κακόν.* 23. *Ὁ πόλεμος πλεῖστα κακὰ φέρει.* 24. *Ἔμφυτός ἐστι τοῖς ἀνθρώποις ἡ τοῦ πλείονος ἐπιθυμία.* 25. *Γυνὴ ἐσθλὴ πλεῖστα ἀγαθὰ τῷ οἴκῳ φέρει.* 26. *Τὰ ἀναγκαῖα τοῦ βίου φέρε ὡς ῥᾷστα.* 27. *Τὸ κελεύειν ῥᾷόν ἐστι τοῦ πράττειν.* 28. *Οἱ τῆς σοφίας κάρποι πεπαίτατοί εἰσι.* 29. *Ἐν τῷ τοῦ πατρὸς κήπῳ οἱ τῆς ἀμπέλου βότρυες πεπαίτεροί εἰσιν ἢ ἐν τῷ τοῦ γείτονος.* 30. *Ἰβηρία τρέφει πιότατα πρόβατα.*

EXERCISE 56.

Translate into Greek:—

1. There is nothing better than a very diligent life. 2. The opinion of the ancients is very good. 3. Time is the best adviser. 4. The truest is the best 5. Grief is a very great evil. 6. Nothing is worse than flattery. 7. The most intemperate men are the slaves of pleasures. 8. Women have nothing more beautiful than wisdom. 9. To free men nothing is worse than anarchy. 10. The crocodile is very long. 11. The son is less than the father. 12. The bad often have more property than the good. 13. War brings many great evils. 14. It is easier to command; it is happier to obey. 15. We enjoy most [*superlative neuter of ἡδύς*] the ripest fruits. 16. My father's sheep are fatter than those of [*the article τὰ*] his neighbour.

ADVERBS AND THEIR FORMATION.

Under the name of adverbs we indicate those indeclinable words which denote the relations of *time* and *place*, or the relations of *way* and *manner*: as, *ἐκεῖ*, *there*; *νῦν*, *now*; *καλῶς*, *well*.

Adverbs of manner are formed from adjectives, by affixing *-ως* to the pure stem of the adjective: *e.g.*—

Adjective.	*Adverb.*
φίλος, loving.	*φίλως*, lovingly.
καλός, beautiful.	*καλῶς*, beautifully.
ἁπλοῦς, simple.	*ἁπλῶς*, simply.
πᾶς, all.	*πάντως*, altogether.
σώφρων, wise.	*σωφρόνως*, wisely.
ταχύς, swift.	*ταχέως*, swiftly.
μέγας, great.	*μεγάλως*, greatly.
ἀληθής, true.	*ἀληθῶς*, truly.
συνήθης, accustomed.	*συνήθως*, according to custom.

The terminations *-θεν*, *-θι*, and *-δε* form adverbs by being added to nouns, pronouns, and verbs, to signify relations of place. Thus, *-θεν* denotes from a place (*whence*); *-θι*, at a place (*where*); and *-δε*, to a place (*whither*). For example, *οὐρανόθεν*, *from heaven*; *οὐρανόθι*, *in heaven*; *οὐρανόνδε*, *to heaven*. With pronouns, *-δε* becomes *-σε*: thus, *ἀλλόσε*, *to some other place*; so with *ἐκεῖ*, *there*—as *ἐκεῖσε*, *thither*. In the plural of the substantives in *-ας*, *-σδε* passes into *-ζε*, as *Ἀθήναζε* for *Ἀθήνασδε* (from *Ἀθῆναι*, *-ῶν*, the city *Athens*).

Adverbs of place terminate in *-ω*: as, *ἄνω*, *above*; *κάτω*, *below*; *ἔξω*, *without*; *ἔσω*, *within*. There are many adverbs which are obviously cases of nouns or pronouns: as, *ἐξαπίνης* (so in Latin, *derepente*), *suddenly*; *πού*, *somewhere*; *ὅπου*, *οὗ*, *where*; *αὐτοῦ*, *on the spot*, *exactly here* or *exactly there*; *οὐδαμοῦ*, *nowhere*. These adverbs are all genitives.

Accusatives are also common: as, *πρώην*, *at the dawn*; *μακράν*, *a long way*; *πέραν*, *beyond a place* (whence the country along the east side of the Jordan had the name of Peræa, that is, *the land beyond*); *δωρέαν*, *gratis*, *gratuitously*; *σήμερον*, *to-day* (Latin *hodie*); *αὔριον*, *to-morrow* (Latin *cras*).

COMPARISON OF ADVERBS.

Adverbs of manner have commonly no peculiar adverbial termination, but employ in the comparative the neuter singular, and in the superlative the neuter plural, of the corresponding adjectives The same fact may be stated thus—namely, that the neuter singular of comparatives may be used adverbially (that is, with an adverbial signification), and that the neuter plural of superlatives may be used with an adverbial signification. For example:—

	From	*Comparative.*	*Superlative.*
σοφῶς	(*σοφός*), wisely.	*σοφώτερον.*	*σοφώτατα.*
σαφῶς	(*σαφής*), clearly.	*σαφέστερον.*	*σαφέστατα.*
χαριέντως	(*χαρίεις*), charmingly.	*χαριέστερον.*	*χαριέστατα.*
εὐδαιμόνως	(*εὐδαίμων*), happily.	*εὐδαιμονέστερον.*	*εὐδαιμονέστατα.*
αἰσχρῶς	(*αἰσχρός*), shamefully.	*αἴσχιον.*	*αἴσχιστα.*
ἡδέως	(*ἡδύς*), pleasantly.	*ἥδιον.*	*ἥδιστα.*
ταχέως	(*ταχύς*), swiftly.	*θᾶττον.*	*τάχιστα.*

Adverbs of place in *-ω* retain that termination in the comparative and superlative:—

	Comparative.	*Superlative.*
ἄνω, above.	*ἀνω-τέρω.*	*ἀνω-τάτω.*
κάτω, below.	*κατω-τέρω.*	*κατω-τάτω.*

So comparatives and superlatives in *-ω* are formed from:—

	Comparative.	*Superlative.*
πέρα, beyond.	*περαιτέρω.*	(*none.*)
τῆλου, at a distance.	*τηλοτέρω.*	*τηλοτάτω.*
ἕκας, at a distance.	*ἑκαστέρω.*	*ἑκαστάτω.*
ἐγγύς, near.	*ἐγγυτέρω.*	*ἐγγυτάτω.*

Some adverbs have a reciprocal relation to each other. The simple forms stand as relatives. By prefixing *π* to the relatives, you make direct interrogatives. Put *ὁ* before the *π*, and you convert the direct into indirect interrogatives and indirect relatives. Prefix τ instead of π, and then you obtain demonstratives: as—

Simple Relative.	*Direct Interrog.*	*Indirect I. and R.*	*Demonstrative.*
ᾗ, whither.	πῇ, whither?	ὅπῃ.	τῇ, there, thither.
ἡνίκα, when.	πηνίκα, at what time?	ὁπηνίκα.	τηνίκα, at that time.
ὅθεν, whence.	πόθεν, whence?	ὁπόθεν.	[τόθεν, thence]
[οἷ, whither.]	ποῖ, whither?	ὅποι.	
ὅτε, when.	πότε, when?	ὁπότε.	τότε, then.
οὗ, where.	ποῦ, where?	ὅπου.	
ὡς, as.	πῶς, how?	ὅπως.	[τώς, so.]

Of these forms, οἷ, τόθεν, and τώς are found only in the poets, and are not to be ordinarily used in prose composition.

THE PRONOUNS.

Pronouns express the relation of an object to the speaker, inasmuch as they present either the speaker himself as the object (*the first person*), the person addressed (*the second person*), or the person spoken of (*the third person*).

Pronouns may be divided into five classes—namely, the personal, the demonstrative, the relative, the indefinite, and the interrogative.

I. PERSONAL PRONOUNS.

(1) *The Substantive Personal Pronouns.*

(i.) The simple—namely, ἐγώ (Latin *ego*), *I;* σύ (Latin *tu*), *thou;* οὗ (genitive), *of himself.*

		Singular.	
Nom.	ἐγώ, I.	σύ, thou.	
Gen.	μοῦ (ἐμοῦ), of me.	σοῦ, of thee.	οὗ, of himself.
Dat.	μοί (ἐμοί), to me.	σοί, to thee.	οἷ, to himself.
Acc.	μέ (ἐμέ), me.	σέ, thee.	ἕ, himself.
		Plural.	
Nom.	ἡμεῖς, we.	ὑμεῖς, you.	σφεῖς [n. σφέα], they.
Gen.	ἡμῶν, of us.	ὑμῶν, of you.	σφῶν, of them.
Dat.	ἡμῖν, to us.	ὑμῖν, to you.	σφίσι, to themselves.
Acc.	ἡμᾶς, us.	ὑμᾶς, you.	σφᾶς [n. σφέα], themselves.
		Dual.	
N.A.	νώ, we (us) two.	σφώ, you two.	
G.D.	νῷν, of (to) us two.	σφῷν, of (to) you two.	[σφωΐν, of (to) them two.]

Αὐτός, -ή, -ό in the nominative signifies not simply *he*, but ***he himself;*** in the oblique cases, however, it is used as a personal pronoun = *he, she, it:*—

	Singular.			*Plural.*		
	M.	F.	N.	M.	F.	N.
Nom.	αὐτός	αὐτή	αὐτό.	αὐτοί	αὐταί	αὐτά.
Gen.	αὐτοῦ	αὐτῆς	αὐτοῦ.	αὐτῶν	αὐτῶν	αὐτῶν.
Dat.	αὐτῷ	αὐτῇ	αὐτῷ.	αὐτοῖς	αὐταῖς	αὐτοῖς.
Acc.	αὐτόν	αὐτήν	αὐτό.	αὐτούς	αὐτάς	αὐτά.

	Dual.		
	M.	F.	N.
N.A.	αὐτώ	αὐτά	αὐτώ.
G.D.	αὐτοῖν	αὐταῖν	αὐτοῖν.

N.B.—The personal pronouns in the nominative are employed only when a special emphasis falls on them, especially in contrasts. This should be observed in the following exercises.

VOCABULARY.

Γράμμα, -ἄτος, τὸ,	a letter; *plur.* letters (that is, learning).
Διαφέρω (gen.),	I differ from.
Διαφθείρω,	I corrupt, destroy.
Συγχαίρω (dat.),	I rejoice with (someone).

EXERCISE 57.

Translate into English:—

1. Ἐγὼ μὲν γράφω, σὺ δὲ παίζεις. 2. Σέβομαι σέ, ὦ μέγα Ζεῦ. 3. Ὦ παῖ, ἄκουε μοῦ. 4. Ὁ πατήρ μοι φίλτατός ἐστι. 5. Ὁ θεὸς ἀεὶ σὲ βλέπει. 6. Εἰ μὲ βλάπτεις, οὐκ ἐχθρῶν διαφέρεις. 7. Ἐγὼ σοῦ ἐρρωμενέστερός εἰμι. 8. Ἡδέως πείθομαι σοί, ὦ πάτερ. 9. Ἡμεῖς ὑμῖν συγχαίρομεν. 10. Ἡ λύρα ὑμᾶς εὐφραίνει. 11 Ὁ θεὸς ἡμῖν πολλὰ ἀγαθὰ παρέχει. 12. Ὁ πατὴρ ὑμᾶς στέργει. 13. Ἀνδρείως μάχεσθε, ὦ στρατιῶται· ὑμῶν γάρ ἐστι τὴν πόλιν φυλάττειν· εἰ γὰρ ὑμεῖς φεύγετε, πᾶσα ἡ πόλις διαφθείρεται. 14. Ὑμῶν ἐστίν, ὦ παῖδες, τὰ γράμματα σπουδαίως μανθάνειν. 15. Ἡ μήτηρ νὼ στέργει. 16. Νῷν ἦν κακὴ νόσος. 17. Σφὼ ἔχετε φίλον πιστότατον. 18. Σφῷν ὁ πατὴρ χαρίζεται· σφὼ γὰρ σπουδαίως τὰ γράμματα μανθάνετε. 19. Ὦ δέσποτα, ἄκουε μοῦ.

EXERCISE 58.

Translate into Greek:—

1. We write, but you play. 2. We two write, but you two play. 3. I honour you, O ye gods. 4. O boy, hear us! 5. God always sees you. 6. If I injure you, you rejoice not with me. 7. You rejoice with us. 8. I willingly hear you, O parents. 9. Father loves thee and me. 10. Mother loves you both. 11. It is my duty to watch the house, for I am the guardian of the house. 12. It is thy duty, O boy, to learn earnestly. 13. The lyre affords pleasure to thee and me. 14. You two have a very faithful friend.

(ii.) The reflexive pronouns: ἐμαυτοῦ, *of myself;* σεαυτοῦ, *of thyself;* ἑαυτοῦ, *of himself.*

Singular.

Gen.	ἐμαυτοῦ, -ῆς.	σεαυτοῦ (σαυτοῦ), -ῆς.	ἑαυτοῦ (αὑτοῦ), -ῆς.
Dat.	ἐμαυτῷ, -ῇ.	σεαυτῷ (σαυτῷ), -ῇ.	ἑαυτῷ (αὑτῷ), -ῇ.
Acc.	ἐμαυτόν, -ήν.	σεαυτόν (σαυτόν), -ήν.	ἑαυτόν (αὑτόν), -ήν, -ό.

Plural.

Gen.	ἡμῶν αὐτῶν.	ὑμῶν αὐτῶν.	ἑαυτῶν (αὑτῶν), or σφῶν αὐτῶν
Dat.	ἡμῖν αὐτοῖς, -αῖς.	ὑμῖν αὐτοῖς, -αῖς.	ἑαυτοῖς, -αῖς (αὑτοῖς, -αῖς), or σφίσιν αὐτοῖς, -αῖς.
Acc.	ἡμᾶς αὐτούς, -άς.	ὑμᾶς αὐτούς, -άς.	ἑαυτούς, -άς, -ά (αὑτούς, -άς, -ά), or σφᾶς αὐτούς, -άς, σφέα αὐτά.

(iii.) The reciprocal pronouns.

While the reflexive pronouns throw the act back on the subject, the reciprocals denote the interchange of the act, or the influence between two persons or two sets of persons. Thus, ἀλλήλων means *of one another;* ἀλλήλοις, *to one another;* and ἀλλήλους, *one another.*

	Plural.	*Dual.*
Gen.	ἀλλήλων.	ἀλλήλοιν, -αιν, -οιν.
Dat.	ἀλλήλοις, -αις, -οις.	ἀλλήλοιν, -αιν, -οιν.
Acc.	ἀλλήλους, -ας, -α.	ἀλλήλω, -α, -ω.

VOCABULARY.

Ἄφθονος, -ον, free from envy.	**Περιφέρω**, I carry round (hence, our *periphery*).
Βλαβερός, -ά, -όν, injurious.	**Πλουτίζω**, I enrich.
Κακοῦργος, -ον (gen.), evil-doing; as a noun, an evil-doer.	**Οὐσία**, -ας, ἡ, essence, property.
Μόνον, only.	**Οὐρανίδαι**, οἱ, the inhabitants of οὐρᾰνός, heaven (that is, the gods).
	Ὠφέλιμος, -ον, useful.

EXERCISE 59.

Translate into English :—

1. Ὁ βίος πολλὰ λυπηρὰ ἐν ἑαυτῷ (*or* αὑτῷ) φέρει. 2. Γίγνωσκε σεαυτόν (σαυτόν). 3. Βούλου ἀρέσκειν πᾶσι, μὴ σαυτῷ μόνον. 4. Ὁ σοφὸς ἐν ἑαυτῷ περιφέρει τὴν οὐσίαν. 5. Φίλων ἔπαινον μᾶλλον ἢ σαυτοῦ λέγε. 6. Ἀρετὴ καθ' ἑαυτήν ἐστι καλή. 7. Οἱ πλεονέκται ἑαυτοὺς μὲν πλουτίζουσιν, ἄλλους δὲ βλάπτουσιν. 8. Οὐχ οἱ ἀκρατεῖς τοῖς μὲν ἄλλοις βλαβεροί, ἑαυτοῖς (*or* σφίσιν αὐτοῖς) δὲ ὠφέλιμοί εἰσιν, ἀλλὰ κακοῦργοι μὲν τῶν ἄλλων, ἑαυτῶν (*or* σφῶν αὐτῶν) δὲ πολὺ κακουργότεροι. 9. Ἡμεῖς μὲν ἡμῖν αὐτοῖς ἥδιστα χαριζόμεθα. 10. Ἄφθονοι Οὐρανίδαι καὶ ἐν ἀλλήλοις εἰσίν. 11. Οἱ κακοὶ ἀλλήλους βλάπτουσιν.

EXERCISE 60.

Translate into Greek :—

1. The wise carry their property about in themselves. 2. The avaricious man enriches himself, but injures others. 3. You gratify yourselves. 4. The intemperate is not hurtful to others and useful to himself; but he is an evil-doer to others, and a much greater evil-doer to himself. 5. Good children, love one another.

KEY TO EXERCISES.

Ex. 47.—1. Speech is a mirror of the mind. 2. Men have intellect as a master. 3. Cherish a well-disposed friend. 4. Good friends have a faithful mind. 5. The voyage is uncertain for sailors. 6. Conduct your life with discretion. 7. The mob has no discretion. 8. Do not quarrel with people. 9. The good are well-disposed to the good. 10. Seek for well-disposed friends. 11. The bones of Orestes were in Tegea. 12. The female servants carry bread in baskets. 13. The gods give both fair and foul voyage to sailors. 14. The intellect is the soul's curb. 15. Often the tempers of men reveal their abilities. 16. The speech of truth is simple. 17. A kind word lightens grief. 18. The cup is silver. 19. Death is called a brazen sleep.

Ex. 48.—1. Ὁ νοῦς ἐστι διδάσκαλος ἀνθρώπου. 2. Ὁ εὔνους φίλος θεραπεύεται. 3. Οἱ εὖνοι φίλοι θεραπεύονται. 4. Τοῖς εὔνοις εἰσι πολλοὶ φίλοι. 5. Ἀπέχου τοῦ ἀνοῦ. 6. Ὀρέγου τῶν εὐνόων φίλων. 7. Κόμιζε τὸν ἄρτον ἐν τοῖς κανοῖς. 8. Φεύγετε τοὺς ἀνοῦς νεανίας. 9. Οἱ νεανίαι ἄνοι φεύγονται. 10. Τὸ κύπελλόν ἐστι χρυσοῦν. 11. Τὰ ἀργυρᾶ κύπελλά ἐστι καλά. 12. Βίον ἄγε σὺν νῳ. 13. Μὴ ἔριζε σὺν τοῖς ἀνοῖς.

Ex. 49.—1. Aristides was very poor, but very just. 2. The Cyclops were most violent. 3. Callias was the richest of Athenians. 4. Nothing is more serviceable than silence. 5. Silence at times is preferable to speech. 6. Nothing is more honourable than wisdom. 7. Wisdom is a possession more honourable than wealth. 8. The Spartans' mode of living was most simple. 9. The more aged exult in the honours of the young. 10. Fatherland is very dear to mankind. 11. The Indians are reckoned a very ancient race. 12. O children, be very quiet. 13. The Spartan young men were stronger than those of the Athenians. 14. Many are more garrulous than swallows. 15. Slaves are often very mendacious and very thievish.

Ex. 50.—1. Ὁ πατήρ ἐστι σοφώτερος ἢ ὁ υἱός. 2. Ἡ μήτηρ ἐστὶ λαλιστέρα ἢ ἡ θυγάτηρ. 3. Ἡ ἀρετή ἐστι τιμιώτατον κτῆμα. 4. Σωκράτης ἦν σοφώτατος τῶν Ἀθηναίων. 5. Οἱ Ἀθηναῖοι ἦσαν σοφώτεροι ἢ οἱ Λακεδαιμόνιοι. 6. Οὐδεὶς τῶν παλαιῶν Ἑλλήνων σοφώτερος ἢ Ἀριστείδου. 7. Ἄνδρες εἰσὶν ἡσυχαίτεροι τῶν παίδων. 8. Οἱ Λακεδαιμόνιοι ἦσαν ἰσχυρότατοι. 9. Αἱ χελιδόνες εἰσὶ λαλίστεραι. 10. Ὁ κόραξ ἐστὶ κλεπτίστατος. 11. Ἡ δίαιτα τοῦ Σωκράτους ἦν ἁπλουστάτη.

Ex. 51.—1. Youth passes by as suddenly as thought, nor is the impetuosity of horses more swift. 2. Old age is heavier than Etna. 3. Death is most like a very deep sleep. 4. Young men rejoice in the praises of old men. 5. The possession of a just friendship is very safe. 6. The mean in all things is safest. 7. Old men are weaker than young. 8. Nothing is safer than right counsel. 9. Crows are very black. 10. Socrates was most continent and temperate. 11. In misfortune men are more prudent than in good fortune. 12. Critias was most rapacious. 13. Aphrodite was the most graceful of all the goddesses.

Ex. 52.—1. Τὸ γῆρας βαρύτατόν ἐστι. 2. Οὐδέν ἐστιν ὠκύτερον τοῦ νοήματος. 3. Ἡ μεσότης ἐστὶν ἀσφαλεστάτη. 4. Οὐδεμία ὄρνις μελαντέρα τοῦ κόρακος. 5. Ὁ παῖς ἐστιν ὠκύς, ὁ ἀνὴρ ὠκύτερος, ὁ δὲ ἵππος ὠκύτατος. 6. Ἥβη ἐστὶν εὐχαριστέρα ἢ τὸ γῆρας. 7. Οἱ Αἰθιόπες εἰσὶ μελάντατοι. 8. Οὐδεὶς τῶν Ἀθηναίων ἐγκρατέστερος τοῦ Σωκράτους. 9. Κριτίας ἦν ἁρπαγίστερος ἢ Ἀλέξανδρος. 10. Οὐδέν ἐστι τῶν καλῶν ἀνθέων εὐχαρίστερον.

SKETCHING FROM NATURE.—III.

[*Continued from p.* 81.]

THEORY OF SKETCHING.

The few remarks we made in our first lesson upon the choice of a subject were offered with a view of cautioning our pupils not to overburden themselves with too many details at first, but to make their early essays from the most simple subjects they could find. It is remarkable, but very little experience will make it evident, that many subjects which at first sight appear to be easy, from the fact that they are composed of few prominent objects, will upon close examination, and especially during the process of drawing, seem to expand into a quantity of detail beyond all previous anticipation. Very frequently a feeling of discouragement is the consequence. We make this last observation, knowing from experience that in the majority of cases the cause of the discouragement did not arise from the unexpected amount of details, but because too little value was placed upon them. The results were failures; indeed, how could they be otherwise? As the pupil progresses his confidence will increase, and he will thus decide for himself the kind of subject, and its extent, that he may feel capable of undertaking.

When we sit down to draw an out-door scene, the first questions that occur to us are: Does it compose well? Are the principal lines of the subject harmoniously arranged and connected with each other? Do any of the less important parts obtrude in such a way as to offend the eye with their masses and angles, to the detriment of other parts of greater consequence? These questions, and others of a like nature, will suggest themselves; and in the course of our experience we shall find out that we have the liberty, or licence, as it is termed, to modify the composition in such a way as to make it agreeable, without sacrificing the truthfulness of the whole. To apply these remarks, let us suppose we are about to draw a scene of which the view is limited; in other words, there is very little choice of position from which to take it. For instance, it might be a tower or ruin, having its most interesting part concealed by trees. The licence we speak of would permit that the position of the trees might be changed, or their branches directed another way; or they might be thinned or cut out so as to admit a view of the part we wish to preserve. Much of this may be done without in the least altering the character of the subject. We give this simply to supply an instance where the taste and judgment of the artist must be exercised.

One of the most pleasing forms of arrangement in the composition of a subject is that of a right-angled triangle. Whether we employ this form to include the whole subject, as in Fig. 5, or in parts or in groups, as in Fig. 6, certain it is that it affords an opportunity for great contrasts, with an harmonious blending of intermediate forms and proportions to combine them. With regard to preserving the triangular form of composition, if desirable, much may be done by slight alterations to make the picture more effective. The growth of a particular tree may be improved, and another, much in the way, may be carried back in the picture. Sometimes the massing of clouds in certain parts will assist; and we may observe here that clouds and skies in general are great resources when difficulties arise in the composition of a landscape, because many liberties may be taken with their arrangement which cannot in the least interfere with the subject—rather the contrary. It is admitted to be correct in principle and in practice to make the sky subservient to the rest of the picture, as it is capable of every variety of change in form, light and shade, and in colour, and yet it need not be false to nature. Besides, a sky can be made exceedingly serviceable in giving effect, by increasing the mass of dark in a picture where it is required, or as a background to throw up objects that are in light. For instance, after a shower, when the sun has broken out, and its rays are lighting up buildings and objects in the distance, the retiring dark mass of clouds, as they dip below the horizon, give, by contrast, additional brilliancy to the effect of the sunlight.

Fig. 5 is an example of the right-angular form, of which a line in the direction from A to B (taking the lines of the hills and the trees) forms the hypothenuse, the ground the base, and the upright trees on the right form the perpendicular. In a subject like this the above arrangement assists the perspective, and many artists do not hesitate in the least to make such alterations in the disposition of the parts, that they may be able to preserve this character. If a couple of poplars stood in the foreground, at *c* or *d*, of the same height as the tree on the right, and on the same plane, they would either leave them out, or put them further back with different heights; or, with the help of the sky as a background, modify their prominence, so as not to destroy the general character of the composition. Some will even venture to remove trees and buildings to other situations altogether. It was the frequent practice of an eminent English landscape-painter to take great liberties with his subjects in this respect. He would remove a large group of trees to the opposite side of a river, rather than they should interfere with the lines he wished to preserve; and especially if they were useful in their new position to give additional improvement to his picture. But a wholesale interference with the true portraiture of the landscape is dangerous without long previous experience; in youthful hands it may act prejudicially in the practical part of the work. It is only they who know well what they are about who can venture to such an extent as we have just mentioned. At first, let our pupils bear in mind that they must proceed step by step; copy Nature closely until they can copy her well; then afterwards they may be able and at liberty to adapt or alter as they find necessary, or as their improved taste and judgment may dictate.

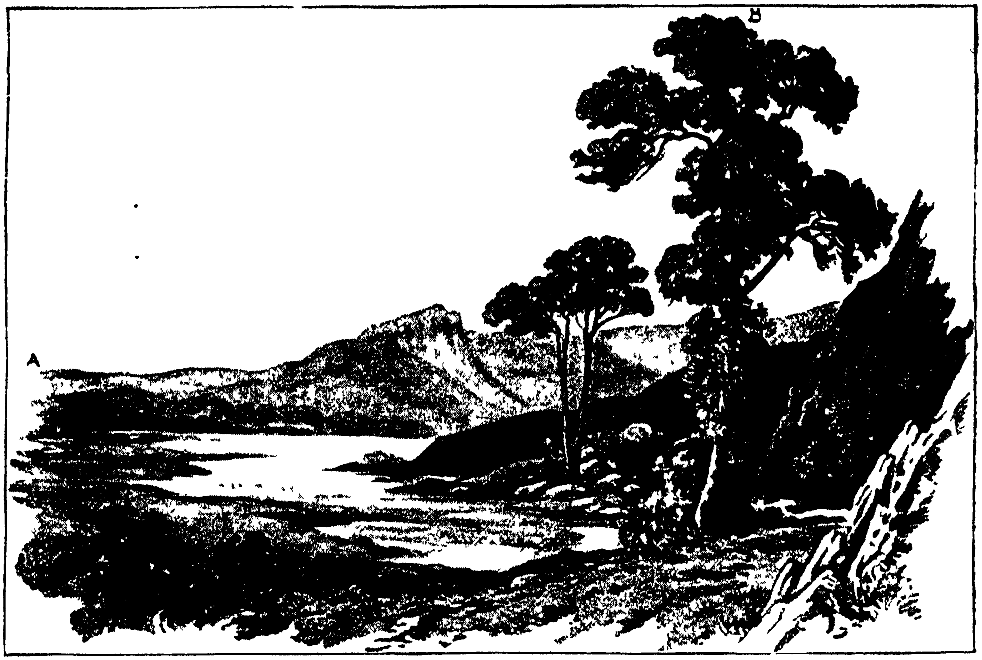


Fig. 5

In our choice and treatment of a subject, we must bear in mind that there should be always one leading object to form the central attraction of the composition, and we must devote sufficient care and attention to its character and details, that the eye may have something to rest upon at once, before it is allowed to wander off to other parts. It is a practice, or rather, a habit of which few are aware, but all follow without any predetermination, first to look for something upon which the eye may repose; and, however interesting the details may be, the principal object will certainly be the last the eye rests upon before it leaves the picture. This being the case the theory of composition teaches us to provide for this result. Very frequently a few figures will give an interest to the subject, and afford an opportunity for concentrating the attention of the spectator upon the picture.

A view which an inexperienced eye would pass by without any especial remark may be made exceedingly interesting. Let us go out and sketch a view on a common: there may be nothing much in it—it may be very dull and flat; but something, we trust, will turn up as we proceed to make it more lively. The one we have chosen has no trees upon it, except one, old and dead, possessing only a few angular and leafless branches. Its trunk, almost totally stripped of the bark, has still clinging to it a piece of ivy; and even that is weak and straggling. On the left of the tree, and at about the centre of the picture, is an unused gravel pit, in which we perceive the leavings and rubbish

Fig 6.

of a recent gipsy camp. These are the principal features, and we might have passed it by, but as we have sat down to draw it, we will try to make a picture out of it. We begin by marking in the general lines of the gravel pit, place the position of the tree on the right of the picture, and indicate its trunk and branches. We also arrange some of the lines of the furze, brambles, and other wild shrubs, whose forms, wave-like, rise and fall, gradually blending both in form and colour into the distance, until the eye is arrested by a low line of far-off hills. This is the arrangement. Now we must trust to details in the drawing to make up the rest, recommencing with the gravel pit, the top of which makes an incline from the tree, and dips into a hollow partly out of sight. The left slope of the pit is covered with brambles and honeysuckles, and we now perceive for the first time a stream of water, running under the shelter of some dock-leaves and foxgloves. Whilst we are drawing these a donkey approaches, and stations itself upon the bare spot under the old tree, and its foal lies down by its side. These are valuable additions to our picture. Two ragged children, wondering what we are about, come out of curiosity to watch our proceedings. Soon finding no amusement in this, they go into the gravel pit, and turn over the rubbish the gipsies have left. These afford other suggestions, and are added to our picture. Some ducks from off the common come and dabble in the little stream amongst the dock-leaves. We take advantage of these also. We then devote our attention to the mid-distance, amongst patches of purple heath and yellow furze, and here we avail ourselves of the pictorial licence already mentioned by removing a cottage, partly surrounded by apple-trees, which is placed beyond the limits of our picture We see only its white gable, pierced with one small window, and its thatch and chimney; but this is enough, and we place it peeping above the furze in the mid-distance, This object helps to break a long monotonous line. and adds another idea to the whole. Beyond this some peat-gatherers have lit a fire, and its curling smoke amongst the dark heather affords another kind of contrast. The whole surface of the scene is broken up by passing lights and cloud-shadows, which, as they float along, bring out alternately brilliant bits of colour, backed up by shades of various tones to relieve them. Thus a sameness is avoided, and what is very important, they assist the perspective. The sky also helps us; its patches of blue, broken up by a few dark clouds, with their thousands of semi-tones and white masses, form an excellent background, against which we put in the sharp and carefully drawn tendrils and leaves of the ivy on the old tree. We finish with the weeds and wild flowers in the foreground, brighten up the children's dresses, put a few more brilliant touches to the ducks, the sparkling water, and the most prominent of the leaves and branches of the brambles, tone down the shadows on and near the donkeys, and having finished our sketch, we exclaim, "All this comes of a dead tree and a gravel pit!"

A repetition of extreme contrasts must be avoided. They would render the picture, if in outline, angular and harsh; if in colour, or light and shade, the result would be "patchy." Such effects are startling, but they are not pleasing when repeated. They must be accompanied by middle tones of various grades. Black and white in juxtaposition are not agreeable; but place combinations of them in conjunction with the extremes, and a very different effect is produced. The same may be said of colours without their combinations; lines also. Suppose a perpendicular line cuts a horizontal one (and where there is a repetition of these the effect becomes worse), it will be necessary to take off the harsh effect they produce by adding inclined lines (*see* Fig. 6, where the stooping and inclined figures unite the two extremes, the one on the ground and the upright figure).

We must now say something about the introduction of figures and other objects, all of which contribute largely to the interest of a picture. If we draw a view of a river and its surroundings, and there is a towing-path at the side, there ought to be boats and barge-horses. A farmyard is not complete without cattle and pigs; or a sea-coast without its boats and fishermen. In short, whatever may be the character of the landscape, the character of the figures must be in unison. To qualify, therefore, in this branch of drawing, we advise our pupils to take it separately; that is, to make especial drawings and studies without any additional landscape. They will find that figure-drawing will require a very close and undivided attention. Afterwards, from a well-stocked portfolio of these studies, selections may be made and employed according to the nature of the subject for special purposes. Many artists are never without their pocket sketch-book and pencil, with which they are always prepared to note down groups of figures, animals, boats, waggons, farm implements, or anything that may be considered of sufficient importance to introduce into a picture. As a preparation for this course of study, we strongly recommend the practice of drawing from simple objects, which can be conveniently and readily obtained. With regard to the practical treatment of trees, which to beginners are the most difficult passages in landscape, we would refer our pupils to the lessons in Drawing. They will there find all the instruction that is necessary for their guidance.

In conclusion we wish to say a few words to those who really possess a desire to excel in drawing from Nature, and to urge them never to let an occasion pass by which can afford them an opportunity for gathering facts and ideas in reference to their art. Constant observation is highly important. It is not absolutely necessary to be always drawing. The mind can at all times gather hints which are valuable. It is not the *forms* of objects only which must engross their attention. There are *effects and combinations* everywhere to be seen, which must be thoughtfully contemplated and stored up for practical use; and if a free and correct manner of drawing has been acquired, the pleasure of being able to use it successfully for the purpose of depicting the beauties of Nature will far more than compensate the student for the labour he has bestowed, or the trouble and anxiety he has experienced in overcoming the difficulties encountered in his progress.

FRENCH.—XXXIII.

[*Continued from p.* 88.]

FRENCH WORDS WHICH ARE SIMILAR IN SPELLING OR PRONUNCIATION, BUT DIFFER IN MEANING (*continued*).

French Words.	Meaning in English.	French Words.	Meaning in English.
Commandant, *nm.*	(milit.) *major.*	Côté, *nm.*	*side.*
Commandeur, *nm.*	*commander (in orders of knighthood).*	Cotte, *nf.*	*petticoat; coat (of arms, of mail);* (ich.) *bullhead.*
Commande, *nf.*	*order for goods.*	Cou, *nm.*	*neck.*
Commandement, *nm.*	*command; word of command; commandment; precept; law.*	Coup, *nm.*	*blow.*
Commode, *adj.*	*convenient; commodious.*	Coût, *nm.*	*cost, costs.*
Commode, *nf.*	*chest of drawers.*	Coupe, *nf.*	*cut, style (of clothes); cutting.*
Compte, *nm.*	*account.*	Coupe, *nf.*	*cup; chalice; quaffing-bowl.*
Comte, *nm.*	*count, earl.*	Cour, *nf.*	*court-yard; Court (of Kings, etc.); Court (of justice).*
Conte, *nm.*	*tale.*	Cours, *nm.*	*course, lecture.*
Confiance, *nf.*	*confidence, trust.*	Court, *adj.*	*short.*
Confidence, *nf.*	*the confiding of a secret.*	Couvert, *nm.*	*cover (spoon, fork, etc.); cover, thicket, shelter.*
Confiant, *adj.*	*trusting; sanguine.*	Couvert, *pp.*	*covered, hidden.*
Confident, *nm.*	*confidant, confidante, bosom friend.*	Cri, *nm.*	*shriek, cry.*
Cor, *nm.*	*corn (on the feet); horn, French hunting horn.*	Cric, *nm.*	*handscrew; lifting jack.*
Corps, *nm.*	*body, corps; corpse.*	Croup, *nm.*	(med.) *croup.*
Cors, *nm. pl.*	(hunt.) *horns; antlers.*	Croupe, *nf.*	*crupper, rump (of horses).*
Cote, *nf.*	*quota; quotation; share; number, letter, figure (to indicate order).*	Cru, *adj.*	*raw, uncooked; crude.*
Côte, *nf.*	*rib; coast.*	Cru, *nm.*	*growth; invention; making.*
		Crue, *nf.*	*rise, swelling (of rivers); growth.*
		Crue (*fem. of* Cru), *adj.*	*raw, uncooked; crude.*
		Cure, *nf.*	(med.) *cure.*
		Cure, *nf.*	*living; parsonage, vicarage.*

French Words.	Meaning in English.
Curé, *nm.*	*parson.*
Cygne, *nm.*	*swan.*
Signe, *nm.*	*sign.*
D.	
Dais, *nm.*	*canopy, dais.*
Des, *art.*	*of the, from the; some, any.*
Dès, *prep.*	*as soon.*
Dés, *nm.*	*thimbles, dice.*
Dam, *nm.*	*hurt; injury, deprivation of the sight of God.*
Dans, *prep.*	*in, into.*
Dent, *nf.*	*tooth, notch.*
Danse, *nf.*	*dance, dancing.*
Dense, *adj.*	*dense.*
Date, *nf.*	*date (of the month, etc.).*
Datte, *nf.*	(bot.) *date.*
De, *prep.*	*of, from.*
Dé, *nm.*	*thimble; die.*
Déceler, *v.*	*to reveal, to disclose, to betray.*
Desceller, *v.*	*to unseal;* (masonry) *to unbed.*
Desseller, *v.*	*to unsaddle, to take off the saddle.*
Décente, *adj.*	*decent.*
Descente, *nf.*	*coming down; declivity; descent.*
Déférer, *v.*	*to confer, to bestow; to tender; to accuse, impeach, prosecute.*
Déferrer, *v.*	*to unshoe (a horse); to nonplus; to confound.*
Dégoûter, *v.*	*to disgust.*
Dégoutter, *v.*	*to drop, to trickle, to drip,* to *dribble.*
Délacer, *v.*	*to unlace.*
Délasser, *v.*	*to refresh, to relax, to divert.*
Dénier. *v.*	*to deny.*
Denier, *nm.*	(antiq.) *denarius; denier; money; an obsolete French coin worth ¼ of a farthing.*
Dès, des, dés.	*see* Dais.
Désert, *adj. nm.*	*deserted; a desert.*
Dessert. *nm.*	*dessert.*
Desserte, *nf.*	*leavings (of the table).*
Dessein, *nm.*	*design, intention, scheme.*
Dessin, *nm.*	*drawing, sketch.*
Détacher, *v.*	*to take out stains.*
Détacher, *v.*	*to detach; to unfasten;* (milit.) *to detail, to tell off.*

French Words.	Meaning in English.
Différend, *nm.*	*quarrel, difference, dispute.*
Différent, *adj.*	*dissimilar, various, different.*
Diligence. *nf.*	*diligence, stagecoach.*
Diligence, *nf.*	*diligence, activity.*
Dom, don, *nm.*	*dom, don; lord; (Spanish and Portuguese title).*
Don, *nm.*	*gift.*
Donc, *conj.*	*then, therefore.*
Dont, *pron.*	*of which, whose.*
Droit, *adj.*	*straight.*
Droit, *nm.*	*right; law.*
Drôle, *adj.*	*droll; amusing.*
Dróle, *nm.*	*scamp, mean, sorry fellow.*
E.	
Eau, *nf.*	*see* Aux.
Écho, *nm.*	*echo.*
Écot, *nm.*	*reckoning, share, score.*
Effort, *nm.*	*effort.*
Éphore, *nm.*	(antiq.) *Ephor.*
Élan, *nm.*	*start, spring; dash; outburst.*
Élan, *nm.*	*elk, moose-deer.*
Embrasement, *nm.*	*conflagration, burning.*
Embrassement, *nm.*	*embrace, kissing.*
Embraser, *v.*	*to kindle; to rouse; to burn.*
Embrasser, *v.*	*to embrace; to kiss.*
Encre, *nf.*	*see* Ancre.
Ennoblir, *v.*	*see* Anoblir.
Entre, *prep.*	*see* Antre.
Environ, *adv.*	*nearly, about.*
Environs, *nm.*	*surroundings; environs, outskirts, suburbs.*
Équivoque, *adj.*	*equivocal, ambiguous, doubtful.*
Équivoque, *nf.*	*equivocation, ambiguity.*
Ere, *nf.*	*see* Air.
Être, *v., nm.*	*to be; being: trunk (of a tree).*
Êtres, *nm., pl.*	*beings; parts, ins and outs (of a house).*
Hêtre, *nm.*	*beach-tree.*
Exaucer, *v.*	*to hear favourably, to grant.*
Exhausser, *v.*	*to raise up; to make higher.*
Exemplaire, *nm.*	*model, pattern; copy (of books), etc.*
Exemplaire, *adj.*	*exemplary.*

French Words.	Meaning in English.
Exprès, *adj.*	*positive, express, clear, plain; a messenger.*
Exprès, *adv.*	*expressly, purposely.*
Express, *nm.*	*express train.*
F.	
Faim, *nf.*	*hunger.*
Feint, *pp.*	*sham, shammed, feigned.*
Fin, *nf.*	*end.*
Fin, *adj.*	*clever, cunning; thin, fine.*
Fait, *pp., nm.*	*done, made; fact.*
Faix, *nm.*	*burden, load.*
Faite, *nm.*	*summit, top.*
Fete, *nf.*	*feast; birthday; treat; fête.*
Fard, *nm.*	*rouge; paint, varnish; disguise.*
Phare, *nm.*	*lighthouse.*
Faste, *nm.*	*pomp, display, ostentation.*
Fastes, *nm., plur.*	*fasti, annals.*
Fausse (*fem. of* Faux), *adj.*	*false, untrue.*
Fosse, *nf.*	*grave, tomb.*
Fausset, *nm.*	*faucet, vent-peg;* (mus.) *falsetto.*
Fossé, *nm.*	*ditch, moat.*
Faux, *nf.*	*scythe.*
Faux, *adj., nm.*	*false; what is false; forgery.*
Feinte, *ppf.*	*sham, shammed, feigned.*
Feinte, *nf.*	*feint.*
Fendeur, *nm.*	*cleaver, splitter (man).*
Fendoir, *nm.*	*cleaver (tool).*
Fente, *nf.*	*chink.*
Fonte, *nf.*	*casting, melting.*
Ferme, *adj.*	*firm.*
Ferme, *nf.*	*farm, farmstead.*
Fétu, *nm.*	*straw.*
Fœtus, *nm.*	*fœtus.*
Feu, *nm.*	*fire.*
Feu, *adj.*	*deceased.*
Fil, *nm.*	*thread; clue.*
Fils, *nm.* (*pl. of* Fil).	*threads; clues.*
Fils, *nm.*	*son.*
Filtre, *nm.*	*filter; love potion, philter.*
Philtre, *nm.*	*love potion, philter.*
Flamand, *nm.* and *adj.*	*Fleming, Flemish.*
Flamant, *nm.*	*flamingo.*
Flan, *nm.*	*custard, cake.*
Flanc, *nm.*	*side; flank.*
Foi, *nf.*	*faith.*
Foie, *nm.*	*liver* (anat.).

French Words.	Meaning in English.
Fois, *nf.*	*time;* trois fois, *three times.*
Fond, *nm.*	*bottom.*
Fonds, *nm.*	*land; landed property; funds, stock, stock-in-trade.*
Fonts, *nm.*	*font.*
Fondeur, *nm.*	*founder, melter, smelter; letter-founder.*
Fondoir, *nm.*	*melting-house (fat, tallow).*
For, *nm.*	*tribunal* (ant.).
Fors, *prep.*	*except.*
Fort, *adj., nm.*	*strong; stronghold, fort.*
Frai, *nm.*	*spawn, spawning; fry; roe, hard roe.*
Frais, *adj.*	*fresh.*
Frais, *nm.*	*costs, expense.*
Franc, *nm.*	*franc* = 10*d.*, *nearly.*
Franc, *adj.*	*straightforward; frank.*
Franc, *nm., adj.*	*Frank, Frankish.*
G.	
Gai, *adj.*	*cheerful, merry.*
Gué, *nm.*	*ford.*
Guet, *nm.*	*watch, look-out.*
Gale, *nf.*	*itch, scab, mange.*
Galle, *nf.*	*oak-apple, gall.*
Gare, *interj.*	*look out! mind! beware!*
Gare, *nf.*	*wet-dock; railway terminus.*
Gars, *nm.*	*lad, youth, boy.*
Gaz, *nm.*	*gas.*
Gaze, *nf.*	*gauze.*
Geai, *nm*	*jay* (ornith.).
Jais, *nm.*	*jet.*
Jet, *nm.*	*spout, jet of water; casting; throw; tiller.*
Général, *adj.*	*general.*
General, *nm.*	*general.*
Genérale, *adj., f.*	*general.*
Genérale, *nf.*	*general's wife; firedrum, general* (milit.).
Germain, *adj.*	*german, first cousin; brother, sister of the whole blood* (law)
Germain, *nm.*	*German.*
Gland, *nm.*	*acorn.*
Glande, *nf.*	(anat.) *gland.*
Grâce, *nf.*	*grace, gracefulness.*
Grasse, *adj. f.*	*fat.*
Graisse, *nf.*	*grease, fat.*
Grèce, *nf.*	*Greece.*
Grave, *adj.*	*grave, weighty; heavy; solemn.*

French Words.	Meaning in English.
Grave, *nm.*	*gravity ; heavy body*(nat. phil.).
Gré, *nm.*	*will.*
Grès, *nm.*	*sandstone.*
Grêle, *adj.*	*slender, slim, lank ; shrill.*
Grêle, *nf.*	*hail ; hail-storm; tumour of the eyelids.*
Gril, *nm.*	*gridiron.*
Grille, *nf.*	*grate ; grating.*
Gris, *adj.*	*grey.*
Grosse, *nf.*	*gross (twelve dozens).*
Grosse, *adj. f.*	*stout, big.*
Guère, *adv.*	*scarcely.*
Guerre, *nf.*	*war.*
H.	
Haine, *nf.*	*see* Aine.
Haire, *nf.*	*see* Air.
Hâle, *nm.*	*heat of the sun.*
Halle, *nf.*	*market, market-place.*
Haleine, *nf.*	*see* Alène.
Hallier, *nm.*	*see* Allié.
Hanche, *nf.*	*see* Anche.
Hart, *nf.*	*see* Are.
Haut, *nm., adj.*	*see* Aulx.
Haute, *adj. f.*	*high.*
Hôte, *nm.*	*host, guest ; landlord, innkeeper.*
Hotte, *nf.*	*basket (carried on the back); basket-funnel.*
Hautesse, *nf.*	*highness.*
Hôtesse, *nf.*	*host, guest ; landlady, innkeeper.*
Hauteur, *nf.*	*see* Auteur.
Héraut, *nm.*	*herald.*
Héros, *nm.*	*hero.*
Hère, *nm.*	*see* Air.
Hêtre, *nm.*	*see* Être.
Heur, *nm.*	*luck.*
Heure, *nf.*	*hour, time, o'clock.*
Heurt, *nm.*	*knock, shook, collision.*
Hocher, *v.*	*to shake.*
Hochet, *nm.*	*rattle (for children) toy; plaything.*
Horion, *nm.*	*blow, thump.*
Orion, *nm.*	(astron.) *Orion.*
Hors, *prep.*	*except ; out.*
Or, *conj.*	*now.*
Or, *nm.*	*gold.*
Hospice, *nm.*	*see* Auspice.
Hôtel, *nm.*	*see* Autel.
Houe, *nf.*	*see* Août.
Houx, *nm.*	*see* Août.
Hun, *nm.*	*Hun.*
Un, *art., adj., m.*	*a, an ; one.*
Hune, *nf.*	(nav.) *top.*
Une, *art., adj. f.*	*a, an ; one.*
Hutte, *nf.*	*hut, cabin.*
Ut, *nm.*	(mus.) *ut, C.*
I.	
Immortelle, *adj. f.*	*immortal.*
Immortelle, *nf.*	*everlasting flower.*
Impériale, *adj. f.*	*imperial.*
Impériale, *nf.*	*roof, outside (of a coach); imperial (beard on the lower lip); (cards), all-fours.*
Insigne, *adj.*	*signal, notorious.*
Insigne, *nm.*	*badge ; insignia.*
Interne, *adj.*	*internal, interior.*
Interne, *nmf.*	*(in schools) boarder ; house-surgeon.*
Issu-e, *pp.*	*born, descended, sprung.*
Issue, *nf.*	*issue; egress; outlet, end, event.*
J.	
Jais, *nm.*	*see* Geai.
Jars, *nm.*	*gander.*
Jarre, *nf.*	*jar, pot, pitcher*
Jet, *nm.*	*see* Geai.
Jeune, *adj.*	*young.*
Jeûne, *nm.*	*fasting.*
Jouer, *v.*	*to play ; to gamble.*
Jouet, *nm.*	*toy, plaything.*
Jumelle, *nf. adj.*	*twin.*
Jumelle, *nf.*	*opera-glass.*
Jumelles, *nf.* pl.	(carp.) *cheeks, sidebeams;*(her.) *gemel ;* (nav.) *fishes of masts, yards.*
L.	
La, *art., pron., f.*	*the ; her.*
La, *nm.*	(mus.) *la, A.*
Là, *adv.*	*there.*
Lacs, *nm.*	*string ; gin (snare) ; love-knot ; springe.*
Lacs, *nm., pl.*	*lakes.*
Las, *interj.*	*alas !*
Las, *adj.*	*tired.*
Lac, *nm.*	*lake.*
Laque, *nf.*	*lac, lake, gum-lake.*
Laque, *nm.*	*lacquer.*
Lai, *adj.*	*lay.*
Lai, *nm.*	*layman ; lay (little poem).*
Laid, *adj., nm.*	*ugly ; what is ugly.*
Laie, *nf.*	*wild sow.*
Lait, *nm.*	*milk.*
Lé, *nm.*	*breadth of linen, cloth, etc.*
Legs, *nm.*	*legacy.*
Les, *art. pron. pl.*	*the ; them.*
Lez, *prep.*	*near.*
Lard, *nm.*	*bacon.*
Lares, *nm., pl., adj.*	(antiq.) *Lares ; household gods, home.*
Le, *art., pron.*	*the ; him, it.*
Lé, *nm.*	*breadth of cloth, linen, etc.*
Lest, *nm.*	(nav.) *ballast.*
Leste, *adj.*	*quick ; nimble.*
Lice, *nf.*	*lists ; field ; arena ; warp.*
Lice, *nf.*	*bitch, hound.*
Lis, *nm.*	*lily.*
Lisse, *adj.*	*smooth; polished.*
Lisse, *nf.*	*warp ;* (nav.) *sheer-rails, drift-rails.*
Lieu, *nm.*	*place, spot.*
Lieue, *nf.*	*league = 2½ miles English.*
Lire, *v.*	*to read.*
Lyre, *nf.*	*lyre ;* (astron.) *Lyra.*
Livrée, *nf.*	*livery.*
Livrer, *v.*	*to deliver ; to betray.*
Livret, *nm.*	*little book.*
Loch, *nm.*	(nav.) *log.*
Looch *or* lok, *nm.*	(med.) *loch.*
Loque, *nf.*	*rag.*
Louer	*to hire, to let ; to rent.*
Louer,	*to praise.*
Lut, *nm.*	(chem.) *luting.*
Luth, *nm.*	(mus.) *lute.*
Lutte, *nf.*	*struggle.*
M.	
Ma, *adj.*	*my.*
Mat, *adj.*	*unpolished.*
Mat, *nm.*	*(at chess) mate, checkmate.*
Mât, *nm.*	(nav.) *mast.*
Mai, *nm.*	*May.*
Maie, *nf.*	(nav.) *trough to drain newly tarred cordage ; kneading-trough.*
Mais, *conj.*	*but.*
Maïs, *nm.*	*maize, Indian corn.*
Mes, *adj.*	*my.*
Mets, *nm.*	*dish (food).*
Mail, *nm.*	*mallet ; mall ; (game ; place).*
Maille, *nf.*	*mesh ; mail; haw (eyes of animals) : an obsolete French coin.*
Maire, *nm.*	*mayor(of a town).*
Mer, *nf.*	*sea.*
Mère, *nf.*	*mother.*
Mal, *adv., nm.*	*badly ; evil.*
Mâle, *nm., adj.*	*male ; manly.*
Malle, *nf.*	*trunk.*
Mânes, *nm. pl.*	*manes, shade, ghost.*
Manne, *nf.*	*manna.*
Mante, *nf.*	*mantle(woman's).*
Menthe, *nf.*	*mint (plant).*
Marc, *nm.*	*(weight) mark ; residuum (of anything strained, boiled, squeezed, etc.).*
Mare, *nf.*	*pool, pond ; trough (used by cider brewers).*
Mars, *nm.*	*March ; Mars.*
Marche, *nf.*	*march, walk ; steps (of stairs) ; move (at chess).*
Marché, *nm.*	*market, market-place.*
Mari, *nm.*	*husband.*
Marie, *nf.*	*Mary.*
Marri, *adj.*	*sorry, vexed.*
Marin, *adj.*	*marine.*
Marin, *nm.*	*mariner ; seaman ; sailor.*
Marine, *adj. f.*	*marine.*
Marine, *nf.*	*navy ; sea-service.*
Martyr, *nm.*	*martyr.*
Martyre, *nm.*	*martyrdom.*
Martyre, *nf.*	*martyr (female).*
Massif, *adj.*	*massive, bulky ; solid (of metals).*
Massif, *nm.*	*group (of trees) ;* (masonry) *solid mass ;* (carp.) *dead wood ; block.*
Ménager, *v.*	*to spare ; to husband.*
Ménager, *adj.*	*sparing, thrifty.*
Menu, *adj.*	*small, slender, thin.*
Menu, *nm.*	*minute detail, particulars, bill of fare.*
Menu, *adv.*	*minutely, in small pieces.*
Mépris, *nm.*	*contempt.*
Méprise, *nf.*	*error, mistake.*
Mil, *adj.*	*one thousand (Christian era).*
Mil, *nm.*	(bot.) *millet.*
Mille, *adj.*	*one thousand.*
Mille, *nm.*	*mile.*
Mine, *nf.*	*look, aspect, mien, appearance.*
Mine, *nf.*	*mine (of metals) ; mine* (milit.).

French Words.	Meaning in English.
Mine, *nf.*	*an obsolete measure=75 quarts English; mina* (Greek autiq.).
Mire, *nf.*	(artil.) *sight, aim; mark.*
Myrrhe, *nf.*	*myrrh.*
Moi, *pron.*	*me.*
Mois, *nm.*	*month.*
Mollet, *adj.*	*soft, softish.*
Mollet, *nm.*	*calf of the leg.*
Mon, *adj.*	*my.*
Mont, *nm.*	*mountain.*
Montre, *nf.*	*sample, show, parade; show-glass, shop window.*
Montre, *nf.*	*watch.*
Moral, *adj.*	*moral.*
Moral, *nm.*	*mental faculties, mind; spirit.*
Morale, *adj. f.*	*moral.*
Morale, *nf.*	*ethics, morals, morality; rebuke, lecture; moral (of fables, etc.).*
More (*or* Maure), *nm.*	*Moor.*
Mors, *nm.*	*horse bit.*
Mort, *nf.*	*death.*
Mort, *nm., pp.*	*dead man; dead.*
Mou, *adj.*	*soft, mellow, weak.*
Mou, *nm.*	*lights (of some animals).*
Moue, *nf.*	*pouting; wry face.*
Moût, *nm.*	*must (unfermented wine).*
Mousse, *adj.*	*blunt.*
Mousse, *nf.*	*moss, froth, foam.*
Mousse, *nm.*	*cabin-boy, apprentice sailor.*
Mur, *nm.*	*wall.*
Mûr, *adj.*	*ripe.*
Mûre, *nf.*	*mulberry.*
Mure, *adj. f.*	*ripe.*
N.	
Naturel, *adj.*	*natural.*
Naturel, *nm.*	*native.*
Naturel, *nm.*	*naturalness; character, disposition.*
Nécessaire, *adj.*	*necessary, indispensable.*
Nécessaire, *nm.*	*necessaries; dressing-case; work-box.*
Nef, *nf.*	*nave (of a church); ship* (ant.).
Nèfle, *nf.*	*medlar* (bot.).
Neuf, *numeral.*	*nine.*
Neuf, *adj.*	*new, newly bought, newly made.*
Ni, *conj.*	*neither, nor.*

French Words.	Meaning in English.
Nid, *nm.*	*nest.*
Nom, *nm.*	*name.*
Non, *adv.*	*no.*
None, *nf.*	(Rom. antiq.) *the 4th part of the day, 3 o'clock p.m.;* (Cath. relig.) *none.*
Nones, *nf. pl.*	(Roman calend.) *7th day of March, May, July, and October; the 5th of the other months.*
Nonne, *also* nonnain, *nf.*	*nun.*
Nouveau, *adj.*	*new, fresh.*
Nouveau, *nm.*	*something new, news.*
Nouvelle, *adj f.*	*new, fresh.*
Nouvelle, *nf.*	*news, novelette.*
Noyer, *v.*	*to drown.*
Noyer, *nm.*	*walnut-tree.*
Nue, *adj. f.*	*bare, nude, naked.*
Nue, *nf.*	*cloud.*
O.	
Officier, *v.*	*to officiate.*
Officier, *nm.*	*officer.*
Oing, *nm.*	*cart-grease.*
Oint, *nm.*	*anointed.*
Or, *conj.*	*see* Hors.
Or, *nm.*	*see* Hors.
Oratoire, *adj.*	*oratorical.*
Oratoire, *nm.*	*oratory (apartment for private devotion); Oratory (a religious order).*
Orion, *nm.*	*see* Horion.
Os, *nm.*	*see* Aulx.
Ou, *conj.*	*see* Août.
Où, *adv.*	*see* Août.
Oubli, *nm.*	*oblivion, neglect, forgetfulness.*
Oublie, *nf.*	*a kind of very thin pastry.*
Oui, *adv.*	*yes.*
Oui, *pp.*	*heard.*
Ouie, *pp. f.*	*heard.*
Ouie, *nf.*	*ear; sense of hearing; hole (of violins, guitars, etc.).*
Ouies, *nf. pl.*	*holes (of violins, guitars, etc.); gills (of fishes).*
Outre, *nf.*	*leather bottle.*
Outre, *conj.*	*besides.*
P.	
Pain, *nm.*	*bread; loaf.*
Pin, *nm.*	*pine-tree.*

French Words.	Meaning in English.
Pair, *adj.*	*even of (numbers); such; like, alike.*
Pair, *nm.*	*peer; equal; mate, par.*
Paire, *nf.*	*a pair, two.*
Père, *nm.*	*father.*
Pers, *adj.*	*bluish.*
Paix, *nf.*	*peace.*
Paye, *nf.*	*pay, salary, wages.*
Pal, *nm.*	*pale (punishment); pale* (her.).
Pâle, *nf.*	*sluice, flood-gate; blade, paddle-board (of an oar);* Cath. religion) *square paste-board covered with muslin to cover the chalice with.*
Pâle, *adj.*	*pallid, ghastly, pale, wan.*
Palais, *nm.*	*palace; palate (of the mouth).*
Palet, *nm.*	*quoit.*
Pan, *nm.*	*skirt; flap (of a coat); large piece of wall; side;* (carp.) *cant.*
Paon, *nm.*	*peacock.*
Par, *prep.*	*by.*
Part, *nm.*	*newly born child (law-term).*
Part, *nf.*	*share, part, side, portion.*
Parallèle, *adj.*	*parallel.*
Parallèle, *nm.*	*parallel, circle of latitude; comparison.*
Parallèle, *nf.*	*parallel line;* (fort.); *trench, parallel.*
Parc, *nm.*	*park.*
Parque, *nf.*	*Fate, Fatal sister.*
Parce que, *conj.*	*because.*
Par ce que.	*by what; by which; by that which.*
Parquer, *v.*	*to pen, to fold* (cattle); *to enclose;* (artil.) *to park.*
Parquet, *nm.*	*wooden floor.*
Parti, *nm.*	*party, side, part, cause; resolution;* (milit.) *detachment.*
Partie, *nf.*	*part; match; line of business;* (com.) *parcel;* (*play*) *game; party; contracting party.*
Pas, *nm.*	*step, pace, footstep, stride, gait; threshold; precedence.*
Pas, *adv.*	*not, no, none.*
Pât, *nm.*	*food (of falcons).*

French Words.	Meaning in English.
Pat, *nm.*	*stalemate (chess).*
Pâte, *nf.*	*paste.*
Patte, *nf.*	*paw (of animals); flap (of pockets); foot (of birds); leg (of insects).*
Pâté, *nm.*	*pie.*
Pâtée, *nf.*	*paste (for poultry); mess (for dogs, cats).*
Paume, *nf.*	*palm (of the hand); tennis (game).*
Pomme, *nf.*	*apple; ball, knob; head (of cabbages, lettuces, etc.; of a walking-stick).*
Pause, *nf.*	*pause; rest, stop.*
Pose, *nf.*	*laying; laying down; posture, attitude; hanging of bells; stationing (of sentries).*
Peau, *nf.*	*skin.*
Pot, *nm.*	*jar, pot.*
Pêche, *nf.*	*peach.*
Pêche, *nf.*	*fishing.*
Péché, *nm.*	*sin.*
Pécher, *v.*	*to sin.*
Pêcher, *nm.*	*peach-tree.*
Pêcher, *v.*	*to fish.*
Pécheur, *nm.*	*sinner.*
Pêcheur, *nm.*	*fisherman.*
Peine, *nf.*	*pain, trouble, difficulty.*
Pène, *nm.*	*bolt (of a lock).*
Pendant, *adj., pp.*	*hanging.*
Pendant, *nm.*	*counterpart; fellow; thing hanging;* (horl.) *pendant; frog (of a sword-belt).*
Pendant, *prep.*	*during.*
Panser, *v.*	*to groom (a horse); to dress (wounds).*
Penser, *v.*	*to think; to believe; to suppose.*
Perche, *nf.*	*perch (fish).*
Perche, *nf.*	*pole, perch; perch (measure);* (hunt) *horns.*
Personnel, *adj.*	*personal; selfish.*
Personnel, *nm.*	*personal character, disposition* (ant.); *personnel (all the persons employed in a public or private establishment), staff.*
Phare, *nm.*	*see* Fard.
Philtre, *nm.*	*see* Filtre.
Pic, *nm.*	*pick, pick-axe;* (nav.) *gaff; peak (of a mountain).*
Pique, *nm.*	*spade (at cards).*
Pique, *nf.*	*pike (long lance).*

French Words.	Meaning in English.
Pie, *nf.*	*magpie.*
Pie, *adj.*	*pious, charitable; piebald (of horses).*
Pis, *nm.*	*udder, dug (of a cow).*
Pis, *adv.*	*worse, worst.*
Pieu, *nm.*	*stake, pile (of wood).*
Pieux, *adj.*	*pious.*
Pinçon, *nm.*	*pinch (the mark left on the skin by a severe pinch).*
Pinson, *nm.*	*chaffinch* (ornit.).
Piquer, *v.*	*to prick; to goad; to sting.*
Piquet, *nm.*	*picket (of soldiers); piquet (card game); picket, stake, peg.*
Placer, *v.*	*to place.*
Placer, *nm.*	*gold-digging.*
Placet, *nm.*	*petition.*
Plaid, *nm.*	*plea, pleading (of a barrister); plaid (Scotch garment).*
Plaie, *nf.*	*sore, wound; evil, plague.*
Plain, *adj.*	*flat, even, plain.*
Plein, *adj.*	*full.*
Plaine, *adj. f.*	*flat, even, plain.*
Plaine, *nf.*	*plain.*
Pleine, *adj. f.*	*full.*
Plainte, *nf.*	*complaint.*
Plinthe, *nf.*	*plinth* (arch.).
Plan, *adj.*	*even, plain, level, flat.*
Plan, *nm.*	*plan, plane, draught, design, model, scheme, project, ground, perspective.*
Plant, *nm.*	*plant, young plant, sapling; plantation.*
Plane, *adj.*	*even, plane, level, flat.*
Plane, *nm.*	*plane-tree, platane.*
Plane, *nf.*	*drawing-knife; spoke-shave.*
Plat, *adj.*	*flat.*
Plat, *nm.*	*dish; mess (of sailors); the flat side of anything; sheet (of glass).*
Pli, *nm.*	*fold, crease.*
Plie, *nf.*	*plaice.*
Plié, *pp.*	*folded.*
Plié, *nm.*	*bend (of the knee in dancing).*
Plier, *v.*	*to fold.*
Plu, *pp.*	*pleased.*
Plu, *pp.*	*rained.*
Plus, *adv.*	*more.*
Plumer, *v.*	*to pluck; to plume; to fleece.*
Plumet, *nm.*	*plume of feathers; plume.*
Poêle, *nm.*	*pall; canopy (at Catholic marriages); stove.*
Poêle, *nf.*	*frying-pan.*
Poil, *nm.*	*hair.*
Poids, *nm.*	*weight.*
Pois, *nm.*	*pen; pea.*
Poix, *nf.*	*shoemaker's wax.*
Poing, *nm.*	*fist.*
Point, *nm.*	*point; dot: full stop; speck; break of day: stitch; moment; difficulty.*
Point, *adv.*	*no, not, none.*
Poison, *nm.*	*poison.*
Poisson, *nm.*	*fish.*
Poli, *adj.*	*polite, civil, polished.*
Poli, *nm.*	*polish.*
Pompe, *nf.*	*pomp, splendour.*
Pompe, *nf.*	*pump.*
Porc, *nm.*	*pork, porker, hog, pig.*
Pore, *nm.*	*pore.*
Port, *nm.*	*seaport, haven, harbour.*
Port, *nm.*	*postage, carriage; aspect, presence; gait, attitude;* (nav.) *burden; compass (of the voice).*
Pou, *nm.*	*louse.*
Pouls, *nm.*	*pulse.*
Pout-de-soie, *also* Pou-de-soie, *nm.*	*paduasoy (sill.).*
Pouce, *nm.*	*thumb; inch.*
Pousse, *nf.*	*shoot, sprout; heaves* (vet.).
Puce, *nf.*	*flea.*
Prémices, *nf. pl.*	*first-fruits.*
Prémisses, *nf. pl.*	(log.) *premises.*
Près, *prep.*	*near.*
Pres, *nm. pl.*	*meadows, grass-fields.*
Prêt, *adj.*	*ready.*
Prét, *nm.*	*loan.*
Préteur, *nm.*	*prætor* (antiq.).
Prêteur, *nm.*	*lender.*
Prix, *nm.*	*price.*
Prix, *nm.*	*prize.*
Prise, *nf.*	*taking, capturing; capture, prize; hold, purchase;* (plur.) *struggle.*
Prise, *nf.*	(med.) *dose; pinch (of snuff).*
Puis, *adv.*	*then, next, after, afterwards.*
Puits, *nm.*	*well.*
Puisant, *pp.*	*drawing, deriving.*
Puissant, *adj.*	*powerful.*
Pyrique, *adj.*	*pyrotechnic.*
Pyrrhique, *nm.*	*Pyrrhic* (poet.).
Pyrrhique, *adj.*	*Pyrrhic.*
Pyrrhique, *nf.*	*Pyrrhic (military dance).*
Q.	
Quand, *adv.*	*see* Camp.
Quant à, *conj.*	*see* Camp.
Quart, *n., adj.*	*see* Car.
Quarte, *n., adj.*	*see* Carte.
Quartier, *n.*	*see* Cartier.
Quoi, *pron.*	*see* Coi.
Quoique, *conj.*	*although, though.*
Quoi que.	*whatever thing.*
R.	
Raie, *nf.*	*line; stroke, streak, stripe; parting (of hair).*
Raie, *nf.*	(icht.) *skate.*
Rais, *nm.*	*spoke (of a wheel);* (ant.) *beam, ray of light* (her.) *beam.*
Rets, *nm.*	*snare, net, netting.*
Rainette, *nf.*	*tree-frog.*
Rainette, *or* Reinette, *nf.*	*pippin (apple).*
Raiponce, *nf.*	(bot.) *rampion, rampion bell-flower.*
Réponse, *nf.*	*answer, reply, response.*
Raisonner, *v.*	*to reason.*
Resonner, *v.*	*to resound.*
Resonner, *v.*	*to ring a bell again.*
Rame, *nf.*	*stick, prop (for peas).*
Rame, *nf.*	*oar.*
Rame, *nf.*	*ream (of paper).*
Ras, *adj.*	*close-shaved; shorn; short-haired.*
Ras, *nm.*	*short-nap cloth;* ras de carene, *shipwright's floating stage;* ras de marée, *race, bore.*
Rat, *nm.*	*rat.*
Rate, *nf.*	(anat.) *milt, spleen.*
Rate, *nf.*	*she-rat.*
Rauque, *adj.*	*hoarse.*
Roc, *nm.*	*rock.*
Reconnaissance, *nf.*	*recognition, acknowledgment.*
Reconnaissance, *nf.*	*reconnoitring party, reconnoitring, reconnoissance.*
Reconnaissance, *nf.*	*pawn-ticket.*
Reformer, *v.*	*to form again.*
Réformer, *v.*	*to improve, to amend, to reform.*
Régal, *nm.*	*feast, entertainment, treat.*
Régale, *nm.*	*organ-stop; organ-pipe.*
Régale, *nf.*	*the king's right to receive the revenue of a vacant bishopric.*
Régale, *adj.*	eau régale, *aqua regia.*
Réglement, *nm.*	*regulation, by-laws, laws.*
Réglément, *adv.*	*regularly.*
Rein, *nm.*	*kidney.*
Rien, *nm.*	*nothing.*
Reine, *nf.*	*queen.*
Rene, *nf.*	*bridle, rein.*
Renne, *nm.*	*rein-deer.*
Remoudre, *v.*	*to grind again (corn, barley, etc.)*
Rémoudre, *v.*	*to grind again (knives, scissors, etc.).*
Repaire, *nm.*	*den; haunt (of wild beasts);* (hunt.) *dung (of hares, wolves, etc.).*
Repère, *nm.*	*bench-mark; datum.*
Repartir, *v.*	*to reply, to answer, to retort,*
Repartir, *v.*	*to set out again.*
Répartir, *v.*	*to divide, to distribute according to a certain prorata.*
Reprouver, *v.*	*to prove again.*
Réprouver, *v.*	*to reprobate, to disapprove.*
Ressort, *nm.*	*spring; elasticity.*
Ressort, *nm.*	*extent of the jurisdiction of a court of justice.*
Ris, *nm.*	*laugh, laughter; smile.*
Ris, *nm.*	*sweet-bread (of the calf).*
Ris, *nm.*	*reef (of sails).*
Riz, *nm.*	*rice.*
Romain, *nm. adj.*	*Roman.*
Roman, *nm.*	*novel, romance.*
Roman, *adj.*	*Romance (languages); Romanish; Romanic.*
Romance, *nf.*	*ballad.*
Rond, *adj.*	*round.*
Rond, *nm.*	*a circle.*
Ronde, *adj. f.*	*round.*
Ronde, *nf.*	*patrol; table song, roundelay;* (mus.) *semibreve; round-hand* (writing).
Rose, *nf.*	*rose.*

French Words.	Meaning in English.
Rosse, *nf.*	*jade, sorry horse.*
Rosse, *nf.*	(icht.) *roach.*
Roue, *nf.*	*wheel.*
Roux, *nf.*	*red-haired; reddish.*
Roux, *nm.*	*russet; reddish colour;* (cook.) *brown butter sauce.*
Roué, *nm.*	*roué, rake, profligate.*
Rouet, *nm.*	*spinning-wheel.*
Ru, *nm.*	*channel* (*of a small stream*).
Rue, *nf.*	(bot.) *rue.*
Rue, *nf.*	*street.*
Ruse, *nf.*	*ruse.*
Russe, *n., adj.*	*Russian.*
S.	
Sa, *adj.*	*see* Ça.
Sas, *nm.*	*see* Ça.
Sain, *adj.*	*see* Ceint.
Saine, *adj.*	*see* Cene.
Sale, *adj.*	*dirty.*
Salle, *nf.*	*large hall.*
Saleur, *nm.*	*salter, curer.*
Saloir, *nm.*	*salting-tub; salt-box.*
Sang, *nm.*	*see* Cent.
Sans, *prep.*	*see* Cent.
Satire, *nf.*	*satire, lampoon.*
Satyre, *nf.*	(Greek poetry.) *satyre.*
Saule, *nm.*	*willow; weeping willow.*
Sol, *nm.*	*formerly used instead of* Sou, *which see.*
Sol, *nm.*	*ground, piece of territory; soil.*
Sol, *nm.*	(mus.) *fifth note of the gamut, sol,* G.
Sole, *nf.*	(icht.) *sole; sole* (*of animals' feet*); (agri.) *break.*
Saur, *adj.*	(*of herrings*) *red;* (*of horses*) *sorrel; yellowish brown.*
Sort, *nm.*	*fate.*
Saut, *nm.*	*leap, jump.*
Sceau, *nm.*	*seal, impression of a seal.*
Seau, *nm.*	*pail, bucket.*
Sot, *nm.*	*fool, simpleton.*
Scène, *nf.*	*see* Cene.
Schah, *nm.*	*see* Chat.
Scie, *nf.*	*see* Ci.
Scythe, *nm.*	*Scythian.*
Site, *nm.*	*site.*
Se, *pron.*	*see* Ce.
Séant, *pp., nm., adj.*	*see* Céans.

French Words.	Meaning in Edglish.
Sèche, *adj.*	*dry, barren.*
Sèche, *or* **Seiche**, *nf.*	*cuttle-fish.*
Sein, *nm.*	*see* Ceint.
Seine, *nf.*	*see* Cene.
Seing, *nm.*	*see* Ceint
Sel, *nm.*	*see* Celle
Selle, *nf.*	*see* Celle.
Sellier, *nm.*	*see* Cellier.
Sense, *adj.*	*see* Censé.
Sensible, *adj.*	*see* Cense.
Serein, *adj.*	*serene, placid.*
Serein, *nm.*	*night dew, evening damp.*
Serin, *nm.*	*canary-bird.*
Serf, *nm.*	*see* Cerf.
Serment, *nm.*	*oath.*
Serrement, *nm.*	*squeeze, squeezing, clasping.*
Serrement, *adv.*	*niggardly.*
Serre, *nf.*	*see* Cerf.
Session, *nf.*	*see* Cession.
Si, *conj.*	*see* Ci.
Signe, *nm.*	*see* Cygne.
Sinistre, *adj.*	*sinister, inauspicious.*
Sinistre, *nm.*	*accident, disaster, fire, conflagration.*
Sire, *nm.*	*see* Cire.
Six, *adj.*	*see* Ci.
Soc, *nm.*	*plough-share.*
Socque, *nm.*	*clog, galoche, pattern.*
Soi, *pron.*	*oneself.*
Soie, *nf.*	*silk; hair* (*of dogs*); *bristle* (*of elephants, hogs, etc.*); *tongue* (*of knives, etc.*).
Soit, *adv., conj.*	*be it so, let it be so; well and good, I grant it; either, or whether.*
Sommer, *v.*	*to summon, to call upon*
Sommet, *nm.*	*top, apex, summit, pinnacle, acme.*
Son, *adj.*	*his, her.*
Son, *nm.*	*bran.*
Son, *nm.*	*sound, noise.*
Sonner, *v.*	*to sound; to produce a sound; to ring a bell; to strike* (*of clocks*); *to toll.*
Sonnet, *nm.*	*sonnet.*
Sou, *nm.*	*French coin = about a half-penny.*
Soûl, *or* **Saoul**, *adj.*	*glutted, surfeited, tipsy, drunk.*
Soûl, *or* **Saoul**, *nm.*	*one's fill, one's belly-full.*
Sous, *prep.*	*under, beneath, in, with.*
Sous, *nm.*	*plural of* sou, *which see.*

French Words.	Meaning in English.
Souffler, *v.*	*to blow, to blow out; to breathe, to inflate, to prompt; to huff* (*at draughts*).
Soufflet, *nm.*	*bellows, pair of bellows; head of a carriage.*
Soufflet, *nm.*	*box on the ear, slap in the face; affront, mortification, humiliation.*
Stras, *nm.*	*strass paste* (*of jewels*).
Strasse, *nf.*	*floss-silk.*
Succin, *nm.*	*yellow amber.*
Succinct, *adj.*	*succinct, concise, brief.*
Sur, *adj.*	*sour, tart, sharp* (*to the taste*).
Sûr, *adj.*	*sure, certain.*
Sur, *prep.*	*on, upon, over, above, in, about.*

French Words.	Meaning in English.
T.	
Tache, *nf.*	*spot, stain, blot.*
Tâche, *nf.*	*task, task-work; job.*
Tacher, *v.*	*to stain, to spot, to blot, to blemish.*
Tâcher, *v.*	*to try, to endeavour, to strive.*
Taie, *nf.*	*pillow-case;* (med.) *film, speck.*
Têt, *nm.*	*fragment of broken glass;* (chem.) *test* (*vessel*); *skull; shell* (*of shell-fishes*).
Taille, *nf.*	*cutting, cut, edge of a sword; pruning;* (surg.) *cystotome.*

KEY TO TRANSLATIONS FROM FRENCH (p. 87).

Provincial Society.

Birth, marriage, and death made up the whole of the history of our society, and these three events differed less there than elsewhere. Imagine to yourself what it was for an Italian lady like me, to be seated round a tea-table several hours in the day after dinner with the social circle of my stepmother. It was composed of seven women, the most solemn of the county, two of whom were "young ladies" of fifty years, timid as at fifteen, but much less gay than at that age. One woman said to the other, "My dear, do you think that the water is boiling enough to pour on the tea?" "My dear," replied the other, "I think it would be too soon, for these gentlemen are not ready to come." "Will they remain long at the table to-day?" said the third; "what do you think about it, my dear?" "I do not know," replied the fourth; "it seems to me that the Parliamentary election ought to take place next week, and it is possible that they may have remained to discuss it." "No," said the fifth, "I think rather that they are talking about that fox-hunt which interested them so much last week, and which is to begin again next Monday; I think, however, that dinner will soon be finished." "Ah, I can scarcely hope it," said the sixth, sighing, and silence began again. I had been in convents in Italy; they appeared to me full of life, compared with this circle, and I did not know what we should come to.

Every quarter of an hour there arose a voice which asked the most insipid questions, to obtain the coldest of answers, and the dulness dispersed for a moment, fell back again with a new weight on these ladies, whom one would have believed to be unhappy, had not custom contracted in childhood taught them to bear everything. At last the gentlemen returned, and this moment, so long waited for, did not bring a great change over the frame of mind of the ladies. The men continued their conversation near the mantelpiece; the ladies remained at the further end of the room, handed round cups of tea, and when the time for leaving arrived, they went away with their husbands, ready to begin again on the next day a life which only differed from that of the day before by the date of the almanack, and by the mark of the years, which at last left their traces on the faces of these ladies as if they had really lived during this time.

APPLIED MECHANICS—IV.

[*Continued from p.* 90.]

MECHANICAL ADVANTAGE OF A MACHINE—VELOCITY RATIO—TERM "MECHANICAL POWER" NOT USED—SIMPLE MACHINES—THE SCREW-JACK—PULLEY BLOCKS, DIFFERENTIAL AND SIMPLE—HYDRAULIC PRESS—EXAMPLES.

HAVING considered the subject of work, we are in a position to discuss what is known as the "mechanical advantage" of various simple machines. By means of a machine we can modify the *amount* of an applied force. and it seems to be in connection with this fact that the term "mechanical advantage" has arisen. We may not, in fact we do not, on the whole derive any "advantage" from the point of view of energy by the use of a machine, for we never get as much energy from the machine as we give to it, but we may be able by the help of a machine to obtain a much greater *force* than that applied.

It is in this sense that the term "mechanical advantage" is employed. For instance, if a small force P balance a large load or force W through the intervention of a machine, the ratio of W to P is called the "mechanical advantage" of the machine. The *real* mechanical advantage of any machine can only be obtained by experiment, and will depend on the condition of the machine as regards lubrication, as well as on the load. What is usually called the mechanical advantage of a machine is really its *velocity ratio*, which depends merely on the sizes of certain parts of the machine, and which is therefore always the same for the same machine. The study of velocity ratio is a geometrical one; but if there were *no friction*, the velocity ratio of a machine would be its mechanical advantage. It is useful to know how to find the velocity ratio of a machine from the dimensions of certain parts, hence it may be well to spend a few minutes in the discussion of this point, on the supposition that friction does not exist. The way to find the *real* mechanical advantage and efficiency will be fully described in the next lesson.

In the older books on mechanics we are introduced to what are called the "mechanical powers." These are the lever, the pulley, the wheel and axle, the inclined plane, the wedge, and the screw. The name "mechanical power" is not a happy one, for the term "power" is now used in a different and perfectly definite sense; nor is there any reason why some of these simple machines or elements should be considered separately from some of the others. It may, however, be of interest to study the so-called mechanical advantage of some of the more important of them. First let us consider

THE INCLINED PLANE.

Let the weight W (Fig. 16) be started to move up the plane, and let P be the pull in the cord which just keeps up steadily the motion imparted to W. Then if l is the length of the plane and h its vertical height, it is evident that when W rolls the whole distance l, P falls through the same distance, since the length l of cord passes over the pulley. Hence the work done by P in falling is $P \times l$, and the work done on W in raising it is $W \times h$. From our law of work, if there is no fraction,

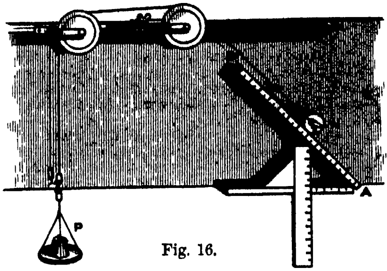


Fig. 16.

$$P \times l = W \times h,$$

$$\text{or,} \quad \frac{W}{P} = \frac{l}{h}.$$

The mechanical advantage of the inclined plane is, then, the ratio of its length to its height. The same rule will be found to hold good if we look at the matter from the force point of view. Three forces act on the weight W, viz., the pull of the cord, gravity or pull of the earth, and the reaction or force of the plane against the weight. The triangle of forces for these three is shown in Fig. 17, and it is easy to see that it is similar to the triangle formed by the outline of the plane itself, and that x is to y in proportion of l to h, or of W to P, which gives the same rule as before.

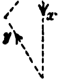


Fig. 17.

We have assumed that the force P acts parallel to the slope of the plane; if, however, it acts parallel to the base of the plane, then when W moves up the entire slope, P will only fall a distance equal to the *base* of the plane, and in that case the mechanical advantage or ratio of W to P is the *base* of the plane divided by its height.

Experimental Illustration. — The student can readily arrange a simple piece of apparatus such as that shown in Fig. 16, and if he employs very well-oiled pulleys, he will probably obtain a result not very different from that just given. In order to get rid of friction as far as possible, the cord may be placed *not* parallel to the plane as shown in Fig. 18, and a very small motion of W only allowed. Then, if a magnified drawing of the two positions be made as in Fig. 19, the direction of the cord is not perceptibly altered, and ab is the amount of cord passed over towards P, whilst kc is the height through which the weight is raised. The result $P \times ab = W \times kc$ will be found to hold almost exactly, hence, when friction is eliminated, the law holds good. We give this because the method here adopted is very often made use of in studying machines, especially those in which motion *alters* the configuration of things.

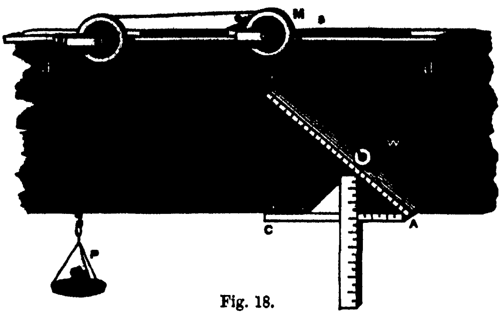


Fig. 18.

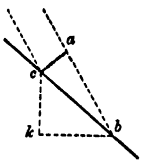


Fig. 19.

It should be noted that in all these cases the work done on W depends only on the *vertical* height through which it is raised, and it does not matter by what path the weight is taken from its first to its final position.

THE SCREW.

The screw is really an inclined plane in which the force usually acts parallel to the base of the plane. This can readily be seen by cutting out a piece of paper in the shape of a right-angled triangle and wrapping it round a cylinder, with the base of the triangle at one end of the cylinder; the slope or hypothenuse of the triangle will form a spiral line or outline of a screw-thread. The pitch of a single-threaded screw is the distance from the centre of one thread to the centre of the next, this distance being measured parallel to the axis of the screw. A screw-jack is shown in Fig 20, arranged for an experiment. In practice, motion is given by means of a handle, but a disc is used here in order to keep the force P at a constant distance from the axis. Suppose P to be just sufficient to raise W steadily, then when the screw gets one turn the load W is raised a distance equal to the pitch of the screw, whilst P falls a distance equal to the circumference of the circle which passes through the centre of the cord on A. Hence, if there is no friction,

$$P \times \text{circumference of } A = W \times \text{pitch of the screw},$$

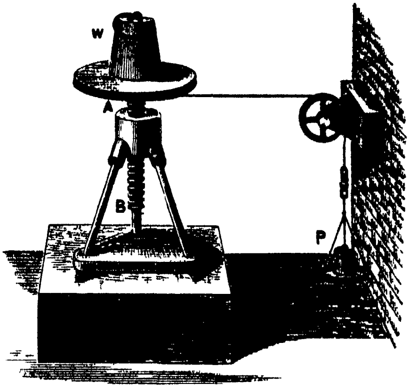


Fig 20.

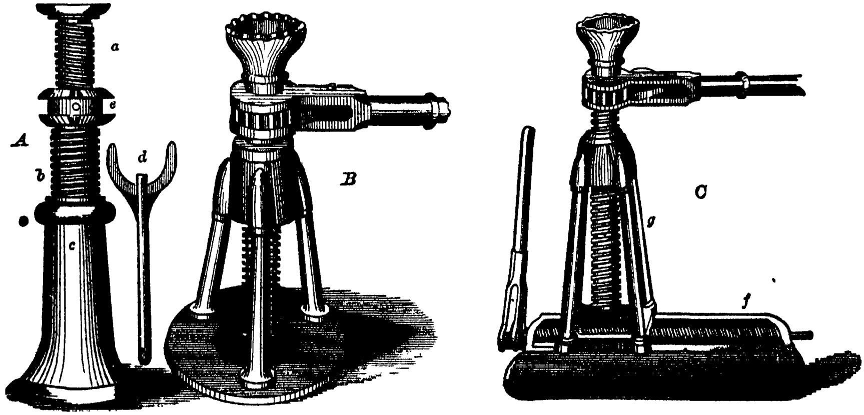


Fig. 21

or, if P is applied by means of a handle as usual, then the mechanical advantage $\frac{W}{P}$ is the *ratio of the circumference described by the point at which P is applied, divided by the pitch of the screw.*

Fig. 21 shows some forms of the screw-jack as used for lifting weights. There are many forms of screw used in practical work. A screw may be single, double, or treble-threaded; the thread may be triangular or square-shaped, a large or short piece of screw may be employed, and the nut may or may not be solid; and our rule will require modification in some of these cases. Thus the propeller of a steamship is only a short bit of screw, and the nut is liquid water. In this case there is a good deal of slipping, or in other words the screw does *not* advance as far as it would if the nut were solid. The following example will make this clear.

Example.—The pitch of a screw-propeller is 16 feet, the speed of the propeller shaft 110 revolutions per minute, and the slip 12 per cent.; find the speed of the vessel in knots per hour. One knot or nautical mile is equal to 6,080 feet.

If there were no slip, the vessel would advance 16 feet for every turn of the propeller, and hence 16 × 110 or 1760 feet per minute.

Its real speed is 1760 − 12 per cent. of 1760.

= 1760 − 211·2, or 1548·8 feet per minute.

= 1548·8 × 60, or 92,928 feet per hour.

$= \frac{92.928}{6080}$, or 15·3 knots per hour.

PULLEY BLOCKS.

In the arrangement of simple pulley blocks shown in Fig. 22, the lower block has three sheaves or pulleys with a groove in each for the cord or rope. The cord is fastened to the upper block, the sheaves of which may be called the fixed pulleys since they do not rise or fall as the load is raised or lowered, passes down over one of the lower pulleys, up over a fixed one, down over another lower one, up over a second fixed one, down over the third movable and up over the third fixed pulley, then has a smaller weight P attached to it. The lower block has the load W attached to it, in fact the load raised *includes* the weight of that block. There are, it will be seen, six parallel cords, each of which will be slackened one foot if we lift the lower block one foot, and hence six feet of cord passes over towards P, which therefore falls six times as fast as W rises. In fact, the mechanical advantage, neglecting friction, of an arrangement of this kind is *twice the number of movable pulleys*, in this case it is six.

DIFFERENTIAL PULLEY BLOCK.

In the last apparatus the sheaves or pulleys in each block are of the same diameter. In the *differential* pulley block this is not the case, hence the mechanical advantage cannot be found by the rule given above.* The apparatus is shown in Fig. 23. The top block, which is shown separately in Fig. 24, has one sheave or pulley only, but with two grooves cut in it, the diameters of these grooves being different. Thus in Fig. 23 the groove C is a little smaller in diameter than the groove B. Hence, when the chain, which is endless, is pulled down at A, so as to give one turn to the top pulley, it is pulled up a distance equal to the circumference of B, and at the same time is let down a distance equal to the circumference of C. On the whole, therefore, one would be inclined to say that the weight is raised a distance equal to the difference of these two circumferences. But this is not the case, though given in many books, for we have to consider the effect of the

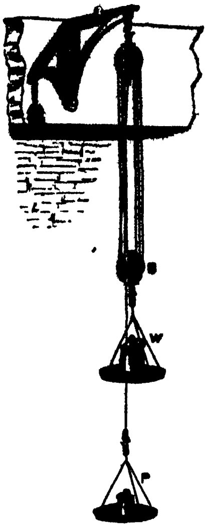


Fig. 22.

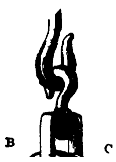


Fig. 23.

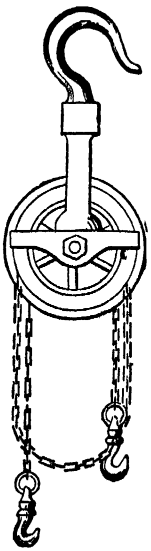


Fig. 24.

lower or movable pulley F, which is shown by itself in Fig. 25. A little consideration will show that if the point D is raised one foot the centre of the pulley, or the weight W, will only be raised half a foot. We may imagine the point D raised a certain distance *relative to the point* E (Fig. 23), the weight then will only be raised half that distance. When the top pulley gets a complete turn, the force at A acts through a distance equal to the circumference of B, whilst at the same time the weight W is raised a distance equal to *half the difference of the circumferences of* B *and* C.

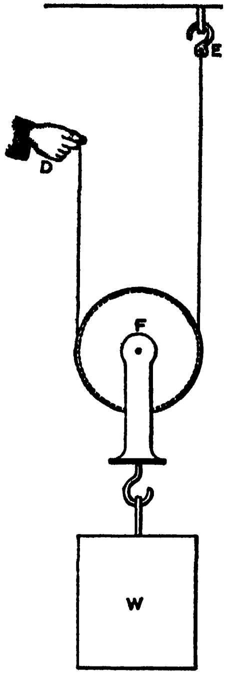


Fig. 25.

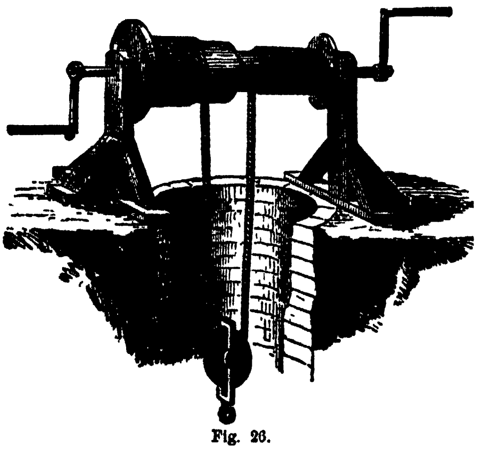


Fig. 26.

From our law of work, if there is no friction,

Force A × circumference or diameter of B = W × $\frac{1}{2}$ difference of circumferences or diameters of B and C,

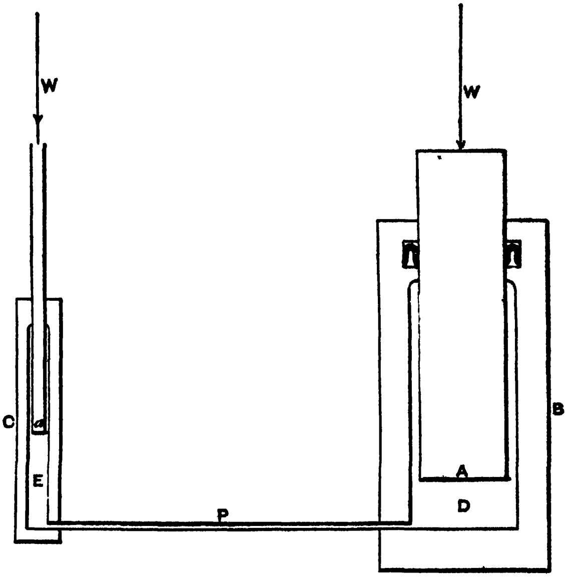


Fig 27.

or the mechanical advantage is the multiplier of A divided by the multiplier of W.

A similar rule holds for the

DIFFERENTIAL OR CHINESE WINDLASS,

shown in Fig. 26, but in that case the applied force A or P, multiplied by the circumference or diameter of the circle described by each handle, is equal to the load W multiplied by half the difference of the circumferences or diameters of the two parts of the axle.

THE HYDRAULIC PRESS.

This is the only other simple machine whose mechanical advantage we will at present consider. It was invented—or rather perfected so as to be practically successful—by Bramah, about the year 1796. Its action will best be understood from the diagrammatic sketch in Fig. 27. In this machine water is used to transmit the force, and there is, therefore, much less friction than in machines where solid parts rub together, the *real* mechanical advantage not being very different from that which we will now find. Referring to Fig. 27, the machine consists of a press B and a pump C, connected by a pipe P. Water is supposed to fill the space D around and under the ram A of the press, the space E under and around the pump plunger *a*, as well as the pipe P. Suppose that water is incompressible—it is very nearly so, being diminished in volume only about $\frac{1}{20000}$th for an increase of pressure of one atmosphere—or imagine that it has already been compressed as much as it will be: then if we cause one foot of the plunger *a* to enter the water-filled cavity E, the water which is displaced must find room for itself somewhere; and if nothing yields or breaks, the only way in which it can do this is by pushing up the ram A of the press. Suppose the area of the cross-section of the ram A to be 100 square inches, and that of the cross-section of the pump plunger *a* one square inch, then if 100 inches of length of *a* are pushed into the pump, 100 cubic inches of water are displaced, and will find room by pushing the ram A up one inch. Thus we see that the movement of the pump plunger and ram are *inversely as the areas of their cross-sections.* The mechanical advantage of the hydraulic press, and of all hydraulic machines of similar construction, is found by *dividing the area of the ram by that of the pump plunger.* The mechanical advantage of the handle by which the pump is worked will be multiplied on this to give the whole mechanical advantage of the arrangement. The outside appearance of the press, as used in warehouses for pressing bales of yarn, cotton, etc., is shown in Fig. 28, where *e* is the press, *f* its ram, *a* the pump, *b* its plunger, worked by the handle *c*, and *d* is the pipe connecting pump and press. Another very useful machine of the same kind, *the hydraulic jack*, is shown in Fig. 29. Referring to the sectional drawing, *f* is the pump plunger worked by the handle *g*. This plunger takes water from the reservoir *a* and forces it into the cistern *c* above the ram *d*, thus causing the outer casing *e* of the jack to rise, lifting a load which may be resting on it. The mechanical advantage of this useful contrivance is found in the way already indicated. As the ram and plunger are made to differ more and more, the mechanical advantage of these machines is greater and greater; but it must be remembered that their relative motion also differs more and more, so that if we construct a hydraulic jack to lift a very great load, it will do so *very slowly*. This fact in regard to machines was put in the older books in the shape of the rule, "what is gained in power is lost in speed."

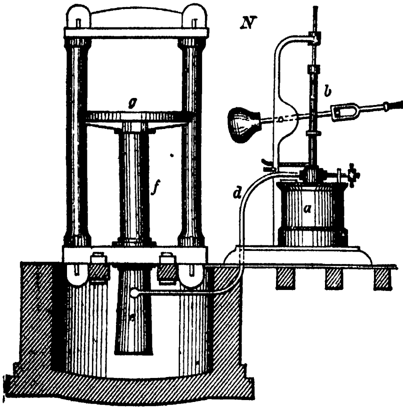


Fig. 28.

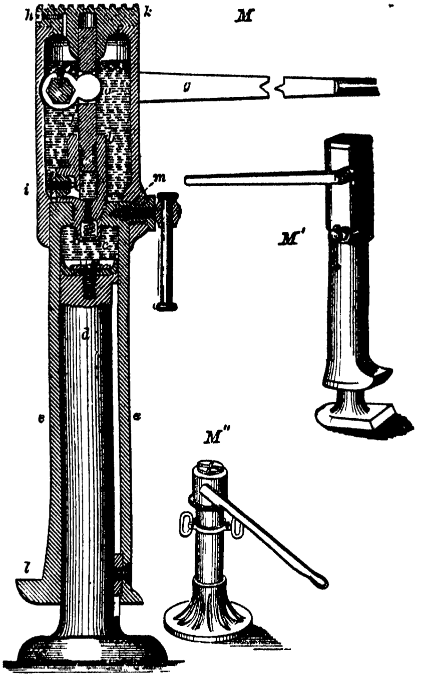


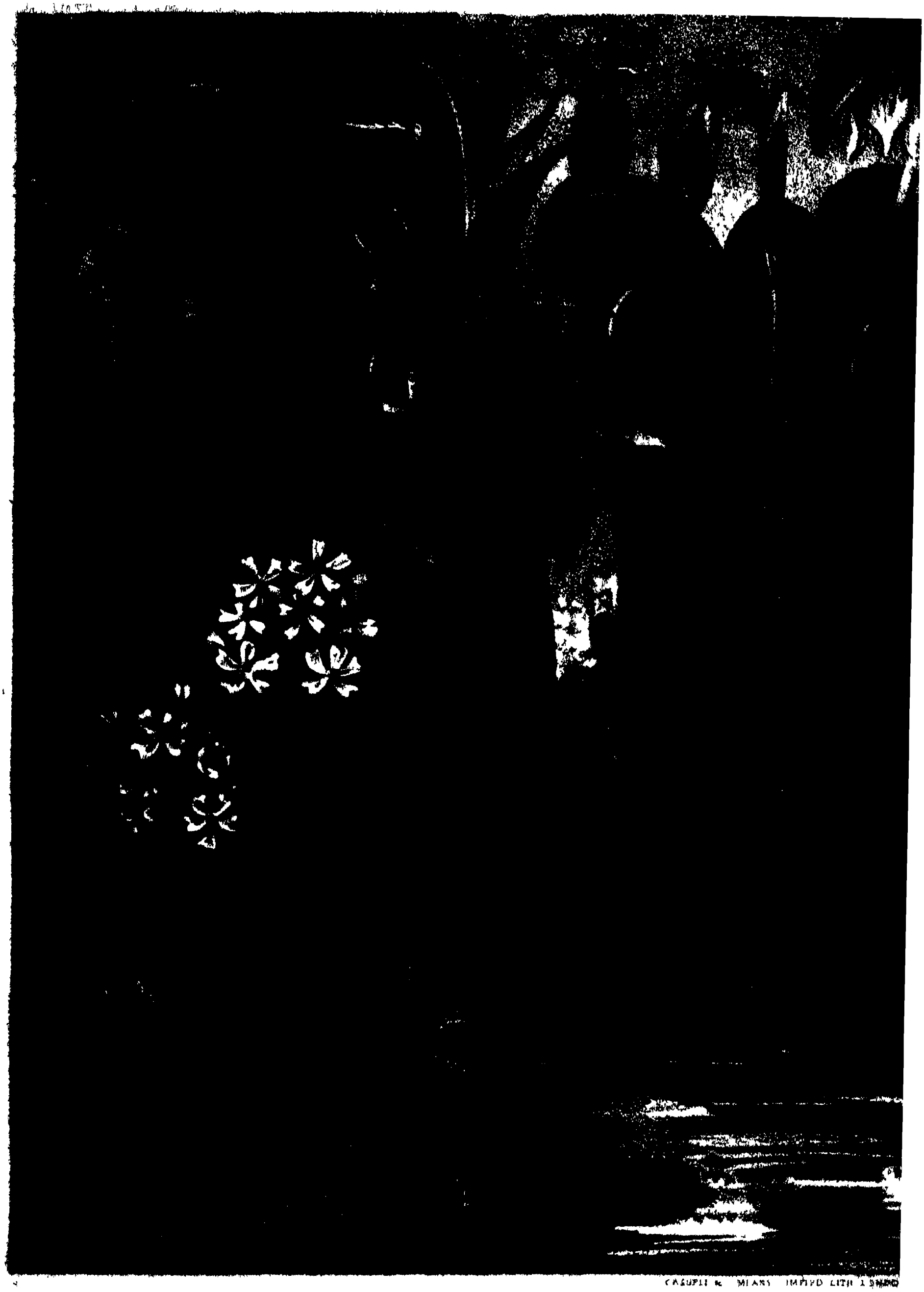
Fig. 29.

We shall not at present consider any more of these simple machines, but shall conclude this lesson by a few practical examples explanatory of the rules arrived at in the lesson.

NUMERICAL EXAMPLES.

1. A plane rises 1 in 20. Find the pull, in the direction of the plane, necessary to move a load of 1 ton, friction being neglected. Answer, 112 lb.

2. The pitch of a screw-jack is ½ inch, the distance from the axis of the screw to the point of



CASSELL & COMPANY LIMITED LITH LONDON

INSECTIVOROUS PLANTS.

1. Darlingtonia Californica.
2. Nepenthes Rafflesiana.
3. Sarracenia Purpurea.
4. Dionæa Muscipula.

the handle at which the moving force is applied is 26 inches. Find the hypothetical mechanical advantage. Answer, 326·7.

3. The diameter of the larger sheave of a differential pulley block is 9 inches, that of the smaller sheave 8·8 inches. Find the mechanical advantage on the assumption that there is no friction. Answer, 90.

4. The pitch of the screw propeller of a steamship is 20 feet, its velocity 80 revolutions per minute, and the slip 10 per cent. Find the speed of the vessel in knots per hour. Answer, 14·2.

5. In a hydraulic press the diameter of the ram is 11 inches, and that of the pump plunger ¾ inch. If the mechanical advantage of the handle of the pump is 10, find the total mechanical advantage. Answer, 2151·1.

6. Find the mechanical advantage, neglecting friction, of a Chinese windlass, the radius of the handle being 18 inches, and the diameters of the two parts of the axle 9 and 8½ inches respectively. Answer, 144.

7. In the last example what would have been the mechanical advantage if the axle had been uniform and of 8 inches diameter. Answer, 4½.

ALGEBRA.—XV.

[*Continued from p. 94.*]

ARITHMETICAL PROPORTION AND PROGRESSION.

266. If *four* quantities are in arithmetical proportion, *the sum of the extremes is equal to the sum of the means.*

Thus, if $a : b :: h : m$, then $a + m = b + h$.
For by supposition, $a - b = h - m$.
And transposing $-b$ and $-m$, $a + m = b + h$.

So, in the proportion, $12 : 10 :: 11 : 9$, we have $12 + 9 = 10 + 11$.

Again, if *three* quantities are in arithmetical proportion, *the sum of the extremes is equal to double the mean.*

If $a : b :: b : c$, then, $a - b = b - c$.
And transposing $-b$ and $-c$, $a + c = 2b$.

267. Quantities which *increase* by a common difference, as 2, 4, 6, 8, 10, etc., or *decrease* by a common difference, as 15, 12, 9, 6, 3, etc., are in *continued arithmetical proportion.*

Such a series is also called an *arithmetical progression;* and sometimes *progression by difference,* or *equidifferent series.*

When the quantities *increase,* they form what is called an *ascending* series, as 3, 5, 7, 9, 11, etc.

When they *decrease,* they form a *descending* series, as 11, 9, 7, 5, 3, etc.

The natural numbers, 1, 2, 3, 4, 5, 6, etc., are in arithmetical progression ascending.

From the definition it is evident that, in an ascending series, each succeeding term is found by *adding the common difference* to the preceding term.

If the first term is 3, and the common difference 2,
The series is 3, 5, 7, 9, 11, 13, etc.
If the first term is a, and the common difference d,
Then $a + d$ is the second term, $a+d+d=a+2d$ the third, $a + 2d + d = a + 3d$ the fourth, $a + 3d + d = a + 4d$ the fifth, etc.

1st. 2nd. 3rd. 4th. 5th.
And the series is a, $a+d$, $a+2d$, $a+3d$, $a+4d$, etc.

If the first term and the common difference are the *same,* the series becomes more simple. Thus, if a is the first term, and also the common difference, and n the number of terms,

Then $a + a = 2a$ is the second term,
$2a + a = 3a$ the third, etc.
And the series is a, $2a$, $3a$, $4a$ . . . . na.

In a *descending* series, each succeeding term is found by *subtracting the common difference* from the preceding term.

If a is the first term, and d the common difference, the series is

1st. 2nd. 3rd. 4th. 5th.
a, $a - d$, $a - 2d$, $a - 3d$, $a - 4d$, etc.

In this manner we may obtain any term by continued addition or subtraction. But in a long series this process would become tedious. There is a method much more expeditious. By attending to the series,

1st. 2nd. 3rd. 4th. 5th.
a, $a + d$, $a + 2d$, $a + 3d$, $a + 4d$, etc.,

it will be seen that the number of times d is added to a is *one less* than the number of the term. Thus,

The *second* term is $a+ d$, *i.e.*, a added to *once d;*
The *third* „ is $a+2d$, „ a , to *twice d;*
The *fourth* „ is $a+3d$, „ a „ to *thrice d*, etc.

So if the series be continued,

The 50th term will be $a + 49d$.
The 100th term „ $a + 99d$.

If the series be *descending,* the 100th term will be $a - 99d$.

In the *last* term, the number of times d is added to a is *one less* than the number of all the terms.

If, then, $d =$ the common difference, $a =$ the first term, $z =$ the last, $n =$ the number of terms, we shall have in all cases,

$z = a \pm (n - 1) \times d$; that is,

1. To find the *last* term of an *ascending* series.

Add to the first term the product of the common difference into the number of terms minus one, and the sum will be the last term.

2. To find the *last* term of a *descending* series.

From the first term subtract the product of the common difference into the number of terms minus one, and the remainder will be the last term.

N.B.—Any other term may be found in the same way. For the series may be made to stop at any term, and that may be considered, for the time, as the last.

Thus, the mth term $= a \pm (m - 1) \times d$.

EXAMPLES.

(1) If the first term of an ascending series is 7, the common difference 3, and the number of terms 9, what is the last term? *Ans.* $z = a + (n - 1)\,d = 7 + (9 - 1) \times 3 = 31$.

(2) If the first term of a descending series is 60, the common difference 5, and the number of terms 12, what is the last term? *Ans.* $z = a - (n - 1)\,d = 60 - (12 - 1) \times 5 = 5$.

(3) If the first term of an ascending series be 9, and the common difference 4, what will the 5th term be? *Ans.* $z = a + (m - 1)\,d = 9 + (5 - 1) \times 4 = 25$.

268. There is one other inquiry to be made concerning a series in arithmetical progression. It is often necessary to find the *sum of all the terms.* This is called the *summation* of the series. The most obvious mode of obtaining the amount of the terms is to add them together. But the nature of progression will furnish us with a more expeditious method.

Let us take, for instance, the series	3,	5,	7,	9,	11,
and also the same inverted,	11,	9,	7,	5,	3.
The sums of the terms will be,	14,	14,	14,	14,	14.
Take also the series	a	$a+d$,	$a+2d$,	$a+3d$,	$a+4d$,
and the same inverted,	$a+4d$,	$a+3d$,	$a+2d$,	$a+d$,	a
The sums will be,	$2a+4d$,	$2a+4d$,	$2a+4d$,	$2a+4d$,	$2a+4d$.

Hence it will be perceived that the sum of *all* the terms in the double series is equal to the sum of the extremes repeated as many times as there are terms. Thus,

The sum of 14, 14, 14, 14, and $14 = 14 \times 5$.

And the sum of the terms in the other double series is $(2a + 4d) \times 5$.

But this is *twice* the sum of the terms in the *single* series. If, then, we put

$a =$ the first term, $n =$ the number of terms,
$z =$ the last, $s =$ the sum of the terms.

we shall have this equation, $s = \frac{a + z}{2} \times n$. Hence—

3. To find the *sum* of all the terms in an arithmetical progression.

Multiply half the sum of the extremes into the number of terms, and the product will be the sum of the given series.

EXAMPLE.—What is the sum of the natural series of numbers, 1, 2, 3, 4, 5, etc., up to 1000?

Ans. $s = \frac{a+z}{2} \times n = \frac{1+1000}{2} \times 1000 = 500500$.

The two formulæ—

$$z = a \pm (n - 1)d, \text{ and } s = \frac{a + z}{2} \times n,$$

contain five different quantities: viz., a, *the first term;* d, *the common difference;* n, *the number of terms;* z, *the last term; and* s, *the sum of all the terms.*

269. From these two formulæ others may be deduced, by which, if any *three* of the *five* quantities are given, the remaining two may easily be found. The most useful of these formulæ are the following:—

By the first formula,

1. *The last term,* $z = a \pm (n - 1)\,d$; in which a, n, and d are given.

Transposing $(n - 1)\,d$,

2. *The first term,* $a = z \mp (n - 1)\,d$; z, n, and d being given.

Transposing a in the first, and dividing by $n - 1$,

3. *The common difference,* $d = \frac{z - a}{n - 1}$; a, z, and n being given.

Transposing and dividing,

4. *The number of terms,* $n = \frac{z - a}{d} + 1$; a, z, and d being given.

By the second formula,

5. *The sum of the terms,* $s = \frac{a + z}{2} \times n$; a, z, and n being given.

Or, by substituting for z its value,

$$s = \frac{2a + (n - 1)\,d}{2} \times n; \text{ in which } a, n, \text{ and } d$$

are given.

Reducing the preceding equation,

6. *The first term,* $a = \frac{2s - dn^2 + dn}{2n}$; s, d, and n being given.

7. *The common difference,* $d = \frac{2s - 2an}{n^2 - n}$; s, a, and n being given.

8. *The number of terms*—

$$n = \frac{\sqrt{(2a - d)^2 + 8ds} - 2a + d}{2d}.$$

a, d, and s being given.

A variety of other formulæ may be deduced from the equations already given, the investigation of which will afford the student a pleasing and profitable exercise.

By the third formula, for example, may be found any number of arithmetical means between two given numbers. For the whole number of terms consists of the *two extremes* and all the *intermediate* terms. If, then, $m =$ number of means, $m + 2 = n$, the whole number of terms. Substituting $m + 2$ for n in the third equation, we have—

The common difference, $d = \frac{z - a}{m + 1}$, in which a, z, and m are given.

Example.—Find 6 arithmetical means between 1 and 43. Here $n = 8$; $a = 1$; $z = 43$; $d = \frac{z - a}{n - 1} = \frac{43 - 1}{8 - 1} = 6$, common difference; $\therefore$ the series is 1, 7, 13, 19, 25, 31, 37, and 43.

It is obvious, from the mode in which we obtain an expression for the sum of an arithmetical series, that *the sum of the extremes is equal to the sum of any other two terms equally distant from the extremes.* Thus, in the series, 3, 5, 7, 9, 11, the sum of the first and last terms, of the first but one and the last but one, etc., is the same in each case, viz., 14. The same is true of every series.

Exercise 68.

1. If the first term of an increasing arithmetical series is 3, the common difference 2, and the number of terms 20, what is the sum of the series?

2. If 100 stones are placed in a straight line, at the distance of a yard from each other, how far must a person travel to bring them one by one to a box placed at the distance of a yard from the first stone?

3. What is the sum of 150 terms of the series

$$\frac{1}{3}, \frac{2}{3}, 1, \frac{4}{3}, \frac{5}{3}, 2, \frac{7}{3}, \text{ etc.?}$$

4. If the sum of an arithmetical series is 1455, the least term 5, and the number of terms 30, what is the common difference?

5. If the sum of an arithmetical series is 567, the first term 7, and the common difference 2, what is the number of terms?

6. What is the sum of 32 terms of the series

$$1, 1\tfrac{1}{2}, 2, 2\tfrac{1}{2}, 3, \text{ etc.?}$$

7. A gentleman bought 47 books, and gave 10 shillings for the first, 30 shillings for the second, 50 shillings for the third, etc. What did he give for the whole?

8. A person put into a charity-box a shilling the first day of the year, two shillings the second day, three shillings the third day, etc., to the end of the year. What was the whole sum for 365 days?

9. How many strokes does a common clock strike in 24 hours?

10. The clocks of Venice go on to 24 o'clock; how many strokes do they strike in a day?

11. Required the sum of the odd numbers 1, 3, 5, 7, 9, etc., continued to 100 terms; and also to n terms.

12. Required the 365th term of the series of even numbers 2, 4, 6, 8, 10, 12, etc.; and also the nth term.

13. The first term of a series is 4, the common difference 3, and the number of terms 100. What is the last term, and also the nth term?

14. A man puts £1 out to interest at 6 per cent.; what will be the amount in 40 years at simple interest?

15. The extremes of an arithmetical series are 2 and 20, and the number of terms is 10. What is the common difference?

16. The extremes of an arithmetical series are 3 and 39, and the common difference 2. What is the number of terms?

17. Find 5 means between 6 and 48.

18. Find 6 means between 8 and 36.

270. Problems of various kinds in arithmetical progression may be solved by stating the conditions algebraically, and then reducing the equations. Thus:—

Example.—Find four numbers in arithmetical progression whose sum shall be 56, and the sum of their squares 864.

Let $x =$ the second of the four numbers,
And $y =$ their common difference.
The series will be $x - y$, x, $x + y$ and $x + 2y$.
By the conditions, $(x - y) + x + (x + y) + (x + 2y) = 56$.
And $(x - y)^2 + x^2 + (x + y)^2 + (x + 2y)^2 = 864$.
That is, $4x + 2y = 56$.
And $4x^2 + 4xy + 6y^2 = 864$.

Reducing these equations, we have $x = 12$, and $y = 4$.

The numbers required, therefore, are 8, 12, 16, and 20.

Example.—A certain number consists of three digits, which are in arithmetical progression, and the number divided by the sum of its digits is equal to 26; but if 198 be added to it, the digits will be inverted. What is the number?

Let the digits be equal to $x - y$, x, and $x + y$, respectively. Then the number $= 100\,(x - y) + 10x + (x + y) = 111x - 99y$, etc. This example will give the result $= 234$.

Exercise 69.

1. The sum of three numbers in arithmetical progression is 9, and the sum of their cubes is 153. What are the numbers?

2. The sum of three numbers in arithmetical progression is 15, and the sum of the squares of the two extremes is 58. What are the numbers?

3. The sum of the squares of the extremes of four numbers in arithmetical progression is 200, and the sum of the squares of the means is 136. What are the numbers?

4. There are four numbers in arithmetical progression; the sum of the squares of the first two is 34, and the sum of the squares of the last two 130. What are the numbers?

5. There are four numbers in arithmetical progression whose sum is 28, and their continued product is 585. What are the numbers?

GEOMETRICAL PROPORTION AND PROGRESSION.

271. If four quantities are in *geometrical proportion, the product of the extremes is equal to the product of the means.* Thus,

$$12 : 8 :: 15 : 10; \text{ therefore } 12 \times 10 = 8 \times 15. \text{ Hence,}$$

Any *factor* may be transferred from one of the means to the other, or from one extreme to the other, without affecting the proportion.

Thus, if $a:mb::x:y$, then $a:b::mx:y$; for the product of the means in both cases is the same.

So, if $na:b::x:y$, then $a:b::x:ny$.

On the other hand, if the product of two quantities is equal to the product of two others, the four quantities will form a proportion, if they are so arranged that those on one side of the equation shall constitute the means, and those on the other side the extremes. Thus, since $6 \times 12 = 8 \times 9$, then, $6:8::9:12$.

Corollary.—The same must be true of *any factors* which form the two sides of an equation. Thus, if

$$(a+b)\times c = (d-m)\times y, \text{ then } a+b:d-m::y:c.$$

If *three* quantities are proportional, the product of the extremes is equal to the *square* of the mean. For this mean proportional is, at the same time, the consequent of the first couplet, and the antecedent of the last. It is, therefore, to be multiplied *into itself;* that is, it is to be *squared.*

Thus, $4:6::6:9$; therefore, $4 \times 9 = 6 \times 6$.

If $a:b::b:c$, then multiplying extremes and means, $ac = b^2$.

Hence, *a mean proportional* between two quantities may be found by *extracting the square root of their product.*

If $a:x::x:c$, then $x^2 = ac$, and $x = \sqrt{ac}$.

In a proportion, either extreme is equal to the product of the means, divided by the other extreme; and either of the means is equal to the product of the extremes, divided by the other mean.

1. If $a:b::c:d$, then $ad = bc$.
2. Dividing by d, $a = bc \div d$.
3. Dividing the first by c, $b = ad \div c$.
4. Dividing it by b, $c = ad \div b$.
5. Dividing it by a, $d = bc \div a$.

That is, the *fourth* term is equal to the *product of the second and third divided by the first.*

N.B.—On this principle is founded the rule of simple proportion in arithmetic, commonly called the "Rule of Three." Three numbers are given to find a fourth, which is obtained by multiplying together the second and third, and dividing by the first.

The propositions respecting the products of the means and of the extremes, furnish a very simple and convenient criterion for determining whether any four quantities are proportional. We have only to multiply the means together, and also the extremes. If the products are equal, the quantities are proportional. If the products are not equal, the quantities are not proportional.

It is evident that the terms of a proportion may undergo any *change* which will not destroy the *equality* of the *ratios*, or which will leave the product of the *means* equal to the product of the *extremes.* These changes are *numerous*, but they may be reduced to a few general principles.

272. Case I.—Changes in the Order of the Terms.

If four quantities are proportional, *the order of the means*, or *of the extremes*, or *of the terms of both couplets, may be inverted without destroying the proportion.*

Thus, if $a:b::c:d$, and $12:8::6:4$, then,

1. *Inverting the means,*[*] $\left\{\begin{array}{l} a:c::b:d \\ 12:6::8:4 \end{array}\right\}$ the 1st is to the 3rd as the 2nd to the 4th.
2. *Inverting the extremes,* $\left\{\begin{array}{l} d:b::c:a \\ 4:8::6:12 \end{array}\right\}$ the 4th is to the 2nd as the 3rd to the 1st.
3. *Inverting the terms of each couplet,*[†] $\left\{\begin{array}{l} b:a::d:c \\ 8:12::4:6 \end{array}\right\}$ the 2nd is to the 1st as the 4th to the 3rd.
4. We may change the *order* of the *two couplets.*

Cor.—The order of the *whole proportion* may be inverted.

N.B. If the terms of only *one* of the couplets are inverted, the proportion becomes *reciprocal* or *inverse.*

If $a:b::c:d$, then a is to b, reciprocally or inversely, as d to c.

273. Case II.—Multiplying or Dividing by the Same Quantity.

If four quantities are proportional, *two analogous or two homologous terms may be multiplied or divided by the same quantity without destroying the proportion.* Thus,

If $a:b::c:d$, then, if *analogous* terms are multiplied or divided, the ratios will not be altered.

1. $ma:mb::c:d$. 2. $a:b::mc:md$.

3. $\frac{a}{m}:\frac{b}{m}::c:d$. 4. $a:b::\frac{c}{m}:\frac{d}{m}$.

If *homologous* terms be multiplied or divided, both ratios will be equally increased or diminished.

5. $ma:b::mc:d$. 6. $a:mb::c:md$.

7. $\frac{a}{m}:b::\frac{c}{m}:d$. 8. $a::\frac{b}{m}:c:\frac{d}{m}$.

Cor.—All the terms may be multiplied or divided by the same quantity. Thus, $ma:mb::mc:md$, or $\frac{a}{m}:\frac{b}{m}::\frac{c}{m}:\frac{d}{m}$.

274. Case III.—Comparing one Proportion with another.

If two ratios are respectively equal to a third, they are equal to each other. (Euclid V., Def. 11.)

This is nothing more than an application of the axiom, that things which are equal to the same are equal to one another.

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[*] This is called *alternation.* (Euclid V., Def. 16.)

[†] This is technically called *inversion.*

$$\left.\begin{array}{ll}\text{1. If} & a:b::m:n\\ \text{And} & c:d::m:n\end{array}\right\}\text{ then } a:b::c:d,\text{ or } a:c::b:d.$$

$$\left.\begin{array}{ll}\text{2. If} & a:b::m:n\\ \text{And} & m:n::c:d\end{array}\right\}\text{ then } a:b::c:d,\text{ or } a:c::b:d.$$

$$\left.\begin{array}{l}\textit{Cor.}\text{—If } a:b::m:n\\ \qquad m:n > c:d\end{array}\right\}\text{ then } a:b > c:d.\ \text{(Euclid V., Def. 13.)}$$

For if the ratio of $m:n$ is greater than that of $c:d$, it is manifest that the ratio of $a:b$, which is *equal* to that of $m:n$, is also greater than that of $c:d$.

N.B. In these instances, the terms which are alike in the two proportions are the *first* two and the *last* two, and the resulting proportion is uniformly direct. But this arrangement is not essential. The order of the terms may be changed in various ways without affecting the equality of the ratios.

The proposition to which these instances of equality belong is usually cited by the words, "*ex æquo*," or "*ex æquali*." (Euclid V., Def. 23.)

Any number of proportions may be compared in the same manner, if the first two or the last two terms in each preceding proportion are the same with the first two or the last two in the following one.

$$\left.\begin{array}{ll}\text{Thus, if} & a:b::c:d\\ \text{And} & c:d::h:l\\ \text{And} & h:l::m:n\\ \text{And} & m:n::x:y\end{array}\right\}\text{ then } a:b::x:y.$$

That is, the first two terms of the first proportion have the same ratio as the last two terms of the last proportion. For it is manifest that the ratio of *all* the couplets is the same.

But if the two means or the two extremes in one proportion be the same with the means or the extremes in another, the four remaining terms will be *reciprocally proportional.*

$$\left.\begin{array}{ll}\text{If} & a:m::n:b\\ \text{And} & c:m::n:d\end{array}\right\}\text{ then } a:c::\frac{1}{b}:\frac{1}{d},\text{ or } a:c::d:b.$$

$$\left.\begin{array}{ll}\text{For} & ab=mn\\ \text{And} & cd=mn\end{array}\right\}\text{ therefore } ab=cd,\text{ and } a:c::d:b.$$

In this example, the two means in one proportion are like those in the other. But the principle will be the same if the *extremes* are alike, or if the extremes in one proportion are like the means in the other.

$$\left.\begin{array}{ll}\text{If} & m:a::b:n\\ \text{And} & m:c::d:n\end{array}\right\}\text{ then } a:c::d:b.$$

$$\left.\begin{array}{ll}\text{Or if} & a:m::n:b\\ \text{And} & m:c::d:n\end{array}\right\}\text{ then } a:c::d:b.$$

The proposition in Geometry which applies to this case is usually cited by the words, "*ex æquo perturbata.*" (Euclid V., Def. 23.)

KEY TO EXERCISES.

EXERCISE 66.

1. 18 and 6.
2. £160 and £40.
3. 2 and 4.
4. 40 and 16.
5. 15 pieces at 45 crowns.
6. A 9 miles and B 6 miles.
7. 1 and 7.
8. A relieved 60; B, 20. A gave £13; B, £18.
9. 7 and 8.
10. 7 persons.
11. 75 yards at 16s.
12. £9 12s. and £5 8s.
13. 18 yards of the finer, 20 of the coarser, and the prices were 20s. and 16s.
14. 36 gals. of Teneriffe wine at 18s. per gallon.
15. 16.
16. 12 gallons and 17 gallons, at 2s. per gallon.
17. 6.
18. 16.
19. 14 and 10.
20. 20 and 40.
21. 121 and 25.
22. 18 and 2.
23. [illegible] and [illegible].
24. 5 and 20.
25. 7 at first.
26. 16.
27. 24 by 18.
28. 15 and 8.
29. 8.
30. 7 rods.
31. 10 by 15.
32. 144.
33. 14 by 10.
34. 9 feet = width; plot, 72 by 54; area = 3,888 sq. ft.
35. 118 and 177.
36. 8 inches.
37. 4 miles per hour.
38. £30.
39. 45·100040038 feet.
40. A, 18 days at 9 miles; B, 13 days at 10 miles.
41. A £1,200, and B £800.
42. 27 yards at 12s.
43. 10 gallons.
44. Pepper, 10s per lb.; ginger, 5s.

EXERCISE 67.

1. The ratio of 44 : 35 is the greater; for $\frac{44}{35} = \frac{396}{315}$, and 11 : 9 = $\frac{11}{9}$ or $\frac{385}{315}$.
2. $2a + 7 : \frac{1}{3}a$.
3. 5.
4. 126.
5. $42ax + 6a : 105by - 70b$.
6. $x^2 - y^2 : bh$.
7. $10x^2 + 34x + 28 : 2x^2 + 9x - 18$ is a ratio of greater inequality.
8. Ratio of equality, or 1.
9. 3024 : 3240 or 14 . 15
10. $21x^3 : 21y^3$ or $x^3 \cdot y^3$.

ITALIAN.—III.

[*Continued from p.* 101.]

PRONUNCIATION OF DOUBLE CONSONANTS.

As the proper vibrated sound of double consonants can only be acquired by much steady practice, we have to request our pupil readers frequently to read aloud the following table :—

Italian.	*Pronounced.*	*English.*
Ala	áh-lah	Wing.
Alla	áhl-lah	To the (fem.).
Ara	áh-rah	Altar.
Arra	áhr-rah	Earnest-money.
Cane	káh-nai	Dog.
Canne	káhn-nai	Canes, reeds, tubes.
Caro	káh-ro	Dear.
Carro	káhr-ro	Car, cart, waggon.
Casa	káh-sa	House.
Cassa	káhs-sa	Chest, box.
Fato	fáh-to	Fate.
Fatto	fáht-to	Done, made, fact, deed.
Fioco	feeó-ko	Hoarse, weak.
Fiocco	feeôk-ko	Flake.
Fumo	foó-mo	Smoke.
Fummo	foóm-mo	We were.
Gota	gô-tah	Cheek, side.
Gotta	gót-tah	Gout.
Mulo	moó-lo	Mule.
Mullo	moól-lo	Barb (a fish).
Tropo	trô-po	Trope.
Troppo	trôp-po	Too much.
Pena	pai-nah	Pain, punishmen
Penna	pén-nah	Pen.
Seta	sái-tah	Silk.
Setta	sêt-tah	Sect.
*Roso**	ró-so	Gnawed.

* One of the exceptional words where the *s* must be pronounced with a sharp hissing sound, though it is placed between two vowels.

Italian.	*Pronounced.*	*English.*
Rosso	ros-so	Red.
Seco	sai-ko	With himself.
Secco	sek-ko	Dryness, dry.
Seno	sai-no	Bosom.
Senno	sen-no	Good sense, intelligence
Sera	sái-rah	Evening.
Serra	sêr-rah	Defile, hothouse.
Sete	sai-tai	Thirst.
Sette	sêt-tai	Seven.
Sono	só-no	I am.
Sonno	són-no	Sleep.
Base	báh-zai	Foundations.
Basse	báhs-sai	Low, vile, base.
Mese	mái-zai	Month.
Messe	mês-sai	Harvest.
Rosa	ró-zah	Rose.
Rossa	rós-sah	Red (fem.).
Steso	stái-zo	Extended.
Stesso	stés-so	The same.
Abate	ah-báh-tai	Abbot.
Abatte	ahb-báht-tai	He batters down, he abates.
Inseto	in-sê-to	I cover with silk, graft.
Insetto	in-sêt-to	Insect.
Invito	in-vée-to	Invitation.
Invitto	in-vít-to	Invincible.
Acceso	aht-tchái-zo	Inflamed, kindled.
Accesso	aht-tches so	Admittance, access.
Contesa	kon-tái-zah	Dispute, contest.
Contessa	kon-tés-sah	Countess.
Acera	áh-tchai-rah	Maple.
Acerra	ah-tchêr-rah	Acerra, a town in Naples.
Anelo	ah-nê-lo	I pant, panting.
Anello	ah-nêl-lo	Ring.
Baco	báh-ko	Worm, silkworm.
Bacco	bákh-ko	Bacchus.
Beco	bê-ko	Dominicus.
Becco	bêk-ko	Beak.
Cacio	káh-tcho	Cheese.
Caccio	káht-tcho	I chase, expel.
Capello	kah-pél-lo	Hair.
Cappello	kahp-pel-lo	Hat.
Dama	dáh-mah	Lady of rank.
Damma	dáhm-mah	Doe.
Ebe	é-bai	Hebe; he grows weak, blunt.
Ebbe	êb-bai	He had.
Face	fáh-tchai	Torch.
Facce	fáht-tchai	Faces (pl.).
Favi	fáh-vee	Honeycombs.
Favvi	fáhv-vee	He does *or* makes there.
Mira	meé-rah	He looks.
Mirra	mír-rah	Myrrh.
Tenero	té-nai-ro	Tender.
Tennero	ten-nai-ro	They held.
Vendete	ven-dái-tai	You sell.
Vendette	ven-dét-tai	Acts of vengeance.
Aceto	ah-tchai-to	Vinegar.
Accetto	aht-tchét-to	I accept.
Accoppi	ahk-kôp-pee	Thou knockest down.
Acori	ah-kó-ree	Scab, scald.
Accorri	ahk-kór-ree	Thou runnest after, *or* pursuest
Adito	áh-dee-to	Admittance, access.
Additato	ahd-dee-táh-to	Indicated, shown.
Afato	ah-fáh-to	Withered, thin
Affatto	ahf-fáht-to	Entirely, quite.
Alato	ah-láh-to	Winged, bird.
Allatto	ahl-láht-to	I suckle.
Aletto	ah-lêt-to	Alecto, one of the three Furies.
Alletto	ahl-lêt-to	I allure.
Aneto	ah-nê to	Dill (an herb).
Annetto	ahn-nêt-to	I annex.
Anulare	ah-noo-láh-rai	Ring-finger.
Annullare	ahn-nool-láh-rai	To abolish, annul.
Asilo	ah-zée-lo	Asylum.
Assillo	ahs-síl-lo	Horse-fly.
Atene	ah-tê-nai	Athens.
Attenne	aht-tén-nai	He kept his word.
Cometa	ko-mái-tah	Comet.
Commetta	kom-mét-tah	He may commit (a crime).
Faceta	fah-tchê-tah	Facetious, droll (fem.).
Faccetta	faht-tchêt-tah	Facet (on cut stones).
Roseto	ro-zái-to	Rose-garden, bed of roses.
Rossetto	ros-sét-to	Reddish.

THE ACCENTS.

1. THE GRAVE ACCENT.

Strictly speaking, there is only one Italian accent, which is the grave accent, marked with a stroke from the left to the right, thus (`). Its use is not left to the discretion of the writer, but is regulated by invariable rules; its omission is therefore an infraction of grammatical laws. A characteristic of this accent is, that only final letters of Italian words can be marked with it. It is placed—

1st. On the last vowel of those words of more than one syllable, the pronunciation of which requires *a very emphatic stress* to be laid on that vowel: as, for example, *pietà* (pecai-táh), piety, pity; *bontà* (bon-táh), goodness; *libertà* (lee-berr-táh), liberty; *carità* (kah-ree-táh), charity; *virtù* (virr-toó), virtue; *così** (ko-seé), thus.

2nd. On some monosyllables, where, to avoid ambiguity and confusion, the grave accent is used as a means of indicating the difference of signification. For example:—

With the Grave Accent.	*Without the Grave Accent.*
À (ah), has (for *ha*).	*A* (ah), to (preposition).
Chè (kai), to the end that, or in order that; for (conjunction).	Che (kai), who, which, what, that (conjunction).
Da (dah), gives, give.	*Da* (dah), from, by.
Di (dee), day.	*Di* (dee), of.
Diè (deee), he gave (for *diede*).	*Die* (dee-ai), day.
È (ê), is.	*E* (ai), and.
Fe (fai), faith (for *fede*).	*Fe'* (fai), he did (for *fece*).
Già (jah), already, indeed.	*Gia* (jée-ah), he went (for *giva*).
Là (lah), *li* (lee), (there).	*La* (lah), *li* (lee), articles and pronouns.
Nè (nê), nor.	*Ne* (nai), a pronoun.
Ò (ô), I have (for *ho*).	*O* (o), or.
Pie (peeê), foot (for *piede*).	*Pie* (peé-ai), pious.
Se (sai), a pronoun.	*Se* (sai), if.
Si (see), yes, so.	*Si* (see), a pronoun.

3rd. It is placed on those monosyllables which have more than one vowel as termination, to indicate the necessity of pronouncing them as monosyllables; as, for example: *ciò* (tchô), that, what; *può* (pooô), he can; *più* (peeoó), more; *giù* (joo), below; *quì* (kwee), here; *siè* (seeê), he is seated (for *siede*).

When any monosyllable, written with the grave accent or unaccented, or when any word of more syllables than one, having the grave accent on its final vowel, is joined to another word so as to make a compound with it, the initial consonant of the latter word (unless an *s* with another consonant to follow) must be strongly vibrated in pronunciation, and therefore *doubled* in writing, and the grave accent of the first word *taken off*. For example:—

È (ê), is, and *vi* (vee), there = *evvi* (êv-vee), there is.

Più (peeoó), more, and *tostò* (tô-sto), soon = *piuttosto* (peeoot-tô-sto), sooner, rather.

Già (jah), indeed, and *mai* (mahee), never = *giammai* (jahm-máhee), never.

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* This is another of those exceptional words where the *s* must be pronounced with a sharp hissing sound, though it is placed between two vowels.

Dà (dah), give, and *mi* (mee), to me = *dammi* (dáhm-mee), give me.

Fa (fah), do, and *mi* (mee), to me = *fammi* (fáhm-mee), do me.

Amò (ah-mô), he loved, and *la* (lah), her = *amolla* (ah-môl-lah), he loved her.

Farò (fah-rô), I shall do, and *lo* (lo), it = *farollo* (fah-rêl-lo), I shall do it.

Fra (frah), between, and *tanto* (táhn-to), so much or so long a time = *frattanto* (fraht-táhn-to), in the meantime.

Da (dah), from, and *lo* (lo), the = *dallo* (dáhl-lo), from the.

Su (soo), upon, and *lo* (lo), the = *sullo* (soól-lo), upon the.

Monosyllables, though naturally unaccented, must be marked with the grave accent when, as last syllables of a compound, they are joined to participles or other words. For example :—

Per (per), through, and *che* (kai), which = *perchè* (perr-kái), why, because.

A (ah), to, and *do* (dô), I give = *addò* (ahd-dô), I apply myself to.

Contra (kón-trah), against, and *fo* (fô), I make = *contraffò* (kon-trahf-fô), I counterfeit.

Ri (ree), a particle, and *ho* (hô), I have = *rihò* or *rio* (ree-o), I have or get again.

Ri (ree), a particle, and *so* (sô), I know = *riso* (ree-sô), I know by hearsay, I learn.

Sopra (só-prah), upon, and *sto* (stô), I stand = *soprastò* (so-prah-stô), I am above.

Tras (trahs), a particle, and *vo* (vô), I go = *trasvò* (trahs-vô), I pass beyond or exceed.

Qua (kwah), here, and *su* (soo), above = *quassù* (kwahs-soó), up here.

Mai (mahee), never, and *no* (nó), not = *mainò* (mahee-nô), no, not at all.

Oi (oee), ah! alas! and *me* (mai), me = *oime* (oee-mái), alas! unhappy me!

Vice (vée-tchai), substitute, and *re* (rai), king = *vicere* (vee-tchai-rái), viceroy.

And so *all* the numerous and similar compounds of *che*, the compounds of *su*, and of the verbs *do*, *fo*, *ho*, *so*, *sto*, *vo*, etc.

2. THE ACUTE ACCENT.

The acute accent has been adopted by modern authors as the mark to show the difference of meaning in some words of the same spelling, though differently pronounced, particularly in the case where words of more than one syllable terminate in the diphthongs *ia*, *ie*, and *io*, and from the use of the acute sign over the *i*, and the necessary stress laid on the syllable thus accented, acquire a different signification. It is a characteristic of the acute sign that it can never be used in final letters, like the grave accent. But the use of this accent is, generally speaking, not regulated by invariable rules, and is frequently left to the discretion of the writer. The acute sign, which we have adopted in these grammatical instructions, exactly answers the purpose for which it has been introduced by Italian writers, with this difference only, that we shall use it throughout the whole course of the grammar, while they place it merely on some words and sometimes to avoid ambiguity.

With the Acute Sign.	*Without the Acute Sign.*
Balía (bah-leé-ah), power.	*Balia* (báh-lee-ah), nurse.
Gía (jeé-ah), he went.	*Già* (jah), already, indeed.
Néi (né-ee), moles, patches.	*Nei* (nái-ee), in the (pl.).
Áncora (áhn-ko-rah), anchor.	*Ancora* (ahn-kó-rah), again.
Stropiccío (stro-pit-tchee-o), friction, rubbing.	*Stropiccio* (stro-pit-tcho), I rub.

3. THE CIRCUMFLEX ACCENT.

The circumflex accent is of more recent use, particularly among poets, to distinguish words of the same form, but of different signification ; as, for example :—

With the Circumflex Sign.	*Without the Circumflex Sign.*
Tôrre (tôr-rai), to take, seize (for *togliere*).	*Torre* (tor-rai), tower.
Côrre (kôr-rai), to gather (for *cogliere*).	*Corre* (kór-rai), he runs.
Amâro (ah-máh-ro), they loved (for *amarono*).	*Amaro* (ah-máh-ro), bitter.
Fêro (fai-ro), they did.	*Fero* (fê-ro), fierce, wild.
Ora (ô-rah), breeze, zephyr.	*Ora* (o-rah), now.
Allôr (ahl-lôr), laurel (for *alloro* or *allori*).	*Allora* (ahl-ló-rah), then.
Udîr (oo-deér), they heard (for *udirono*).	*Udire* (oo-deé rai), to hear.

THE APOSTROPHE.

The apostrophe is essentially different from accent, and indicates that the word on which it is placed has been deprived of a vowel or of a syllable. Where, therefore, for the sake of harmony, at the beginning or end of a word, a vowel is omitted because the preceding word terminates with a vowel or the subsequent word begins with one, the apostrophe must be placed. It can never be used in the middle, and all omissions and contractions in the middle of words must be written without this sign. For example : *l' amore* (pronounced lah-mó rai), love (for *lo amore*); *dell' anima* (del-láh-nee-mah), of the soul (for *della anima*); *dall' uomo* (dahl-looô-mo), from the man (for *dallo uomo*); *capo d' opera* (káh-po dô-pai-rah), a masterpiece, an odd man (for *capo di opera*); *s' io posso* (sée-o pôs-so), if I can (for *se io posso*); *pens' io* (pen-sée-o), I think (for *penso io*); *sopra 'l letto* (só-prahl lêt-to), upon the bed (for *sopra il letto*); *sotto 'l cielo* (sót-tol tchê-lo), under the sky (for *sotto il cielo*); *e 'n questo, e 'n quello* (en kwái-sto, en kwél-lo), as well in the latter as the former (for *e in questo, e in quello*); *tra 'l sì e 'l no* (trahl see el nô), between yes and no, that is, hesitating (for *tra il sì e il no*).

The use of the apostrophe at the beginning of a word is more frequently found in poetry than in prose.

It is necessary to bear in mind the distinction between the *apostrophe* as a sign of elision, and the *abbreviation* of words where letters are omitted without the use of this sign. We consider it necessary to state some elementary rules with respect to the abbreviation of words.

1. The final vowel of any Italian word may be, and always without the use of the apostrophe,

omitted, if it is immediately preceded by one of these four consonants, *l*, *m*, *n*, and *r*, the so-called liquid consonants or liquids; and if, at the same time, the subsequent word should commence with a consonant, except the *s impure*, as the Italians call it—that is, *s* followed by another consonant, as, *spirito*, spirit; *scettro*, sceptre. For example: *il carneval passato* (il kahrr-nai-váhl pahs-sáh-to), the last carnival (for *il carnevale passato*); *a man destra* (ah mahn dê-strah), on the right hand (for *a mano destra*); *ogni uom tacea* (ón-nyee ooôm tah-tchái-ah), every man was silent (for *ogni uomo tacea*); *vuol far questo* (vooôl fahr kwái-sto), he wants to do this (for *vuole fare questo*).

2. In words ending with *llo*, and having the accent of tone on the syllable preceding *lo*, it is customary to omit the whole of the syllable *lo*, if the subsequent word begins with a consonant which is not the *s impure*. For example: *bêl* for *bêllo*, beautiful; *quel* for *quéllo*, that, the former; *cavál* for *cavállo*, horse; *uccêl* for *uccêllo*, bird; *fratêl* for *fratêllo*, brother; *tranquíl* for *tranquíllo*, tranquil; *cervêl* for *cervêllo*, brains; *ruscêl* for *ruscêllo*, brook, etc.

3. The abbreviations or omissions of the final vowels mentioned in the two preceding rules can never take place in that part of a sentence which requires a pause, that is, before a comma, colon, or period. It is, therefore, not allowable to say *Ella ha una bella man*, she has a fine hand, but *mano*; not *Chi è quel signor?* who is that gentleman? but *signore*, etc.

We will here give a general and concluding pronouncing table, showing the most complicated combinations of vowels with consonants of the whole of the Italian language:—

Italian.	*Pronounced.*	*Italian.*	*Pronounced.*
Ca,	kah.	*Gli,*	gli or llyee.
Co,	ko or kó.	*Glo,*	glo or glô.
Cu,	koo.	*Glu,*	gloo.
Ce,	tchai or tchê.	*Glia,*	llyah.
Ci,	tchee.	*Glie,*	llyai or llyê.
Che,	kai or kê.	*Glio,*	llyo or llyô.
Chi,	kee.	*Gliu,*	llyoo.
Cia,	tchah.	*Gna,*	nnyah.
Cie,	tchai or tchê.	*Gne,*	nnyai or nnyê.
Cio,	tcho or tchó.	*Gni,*	nnyee.
Ciu,	tchoo.	*Gno,*	nnyo or nnyó.
Chia,	keeah.	*Gnu,*	nnyoo.
Chie,	keeai or keeê	*Gua,*	gwah.
Chio,	keeo or keeó.	*Gue,*	gwai or gwê
Chiu,	keeoo.	*Gui,*	gwee.
Ga,	gah.	*Guo,*	gwo or gwô
Go,	go or gó.	*Ja,*	yah.
Gu,	goo.	*Je,*	yai or yê.
Ge,	jai or jé.	*Jo,*	yo or yô.
Gi,	jee.	*Ju,*	yoo.
Ghe,	ghai or ghé.	*Qua,*	kwah.
Ghi,	ghee.	*Que,*	kwai or kwê.
Gia,	jah.	*Qui,*	kwee.
Gie,	jai or jê.	*Quo,*	kwo or kwô.
Gio,	jo or jô.	*Sca,*	skah.
Giu,	joo.	*Sco,*	sko or skó.
Gla,	glah.	*Scu,*	skoo.
Gle,	glai or glê.	*Sce,*	shai or shê.
Sci,	shee.	*Sciu,*	shoo.
Sche,	skai or skê.	*Schia,*	skeeah.
Schi,	skee.	*Schie,*	skeeai or skeeê.
Scia,	shah.	*Schio,*	skeeo or skeeô.
Scie,	shai or shê.	*Schiu,*	skeeoo.
Scio,	sho or shó.		

We shall now enter on the grammar proper of the Italian language.

With regard to the selection of exercises, we shall not scruple, in addition to our own, to make a free use of examples which have passed the test of years of experience in the best schools of Italy and Germany.

The exercises ought to be read over frequently, and always aloud; and if committed to memory, so much the better for the knowledge of the student.

THE ARTICLE—NOUNS DECLINED WITH AND WITHOUT THE ARTICLE.

There are three articles in the Italian language, *il* and *lo* for the masculine, and *la* for the feminine gender, equivalent to the English definite article *the*.

The article *il* can only be used before those masculine words which begin with a consonant, excepting always *s* impure—*i.e.*, *s* followed by another consonant. The plural is *i*. For example:—

Il giar-di-no, the garden.	*Il si-gnó-re*, the gentleman.
I giar-dí-ni, the gardens.	*I si-gnó-ri*, the gentlemen.

The article *lo*, without the apostrophe, can only be used before those masculine words which begin with the *s* impure. The plural of *lo* is *gli*. For example:—

Lo spí-ri-to, the spirit.	*Lo stra-niê-re*, the stranger.
Gli spí-ri-ti, the spirits.	*Gli stra-niê-ri*, the strangers.

The article *lo* is also used before all masculine words that begin with a vowel; but in such a case the apostrophe must be used thus, *l'*. For example:—

L' án-ge-lo, the angel.	*L' im-piê-go*, the office or employment.
Gli án-ge-li, the angels.	*Gl' im-piê-ghi*, the offices or employments.

The plural *gli* only requires the apostrophe before words commencing with the vowel *i*, and never before words commencing with the vowels, *a*, *e*, *o*, and *u*; which is clearly a necessary usage to maintain the squeezed sound of the word *gli* (llyee) in these cases.

The article *la* can only be used before words of the feminine gender which begin with consonants. The plural is *le*. For example:—

La tá-vo-la, the table.	*La má-dre*, the mother.
Le tá-vo-le, the tables.	*Le má dri*, the mothers.

The article *la* must have the apostrophe, *l'*, when it comes before words of the feminine gender commencing with a vowel. For example:—

L' á-ni-ma, the soul.	*L' ér-ba*, the herb or grass.
Le á-ni-me, the souls.	*L' ér-be*, the herbs or grasses.

One must place the apostrophe on the plural *le* before words of the feminine gender commencing with the vowel *e*.

It is obvious that the six words above mentioned, constituting the three articles in the singular and plural, *il*, *lo*, *la*, *i*, *gli*, and *le*, must frequently meet monosyllables, and therefore occasion dissonance. As harmony is a marked characteristic of the language, some means must be found to correct this. This is effected by contractions, in which letters are changed, omitted, or added according to laws dictated by the conveniences of pronunciation, by custo , and by harmony, as:—

For	*di il*	write	*dél.*	For	*in i*	write	*néi.*
,,	*di i*	,,	*déi.*	,,	*in lo*	,,	*nél-lo.*
,,	*di lo*	,,	*dél-lo.*	,,	*in l'*	,,	*néll'.*
,,	*di l'*	,,	*déll'.*	,,	*in gli*	,,	*né-gli.*
,,	*di gli*	,,	*dé-gli.*	,,	*in la*	,,	*nél-la.*
,,	*di la*	,,	*dél-la.*	,,	*con il*	,,	*cól.*
,,	*di le*	,,	*dél-le.*	,,	*con i*	,,	*cói.*
,,	*a il*	,,	*al.*	,,	*con lo*	,,	*cól-lo.*
,,	*a i*	,,	*ai.*	,,	*con l'*	,,	*cóll'.*
,,	*a lo*	,,	*ál-lo.*	,,	*con gli*	,,	*có-gli.*
,,	*a l'*	,,	*all'.*	,,	*con la*	,,	*cól-la.*
,,	*a gli*	,,	*á-gli.*	,,	*con le*	,,	*cól-le.*
,,	*a la*	,,	*ál-la.*	,,	*su il*	,,	*sul.*
,,	*a le*	,,	*ál-le.*	,,	*su i*	,,	*sui.*
,,	*da il*	,,	*dal.*	,,	*su lo*	,,	*súl-lo.*
,,	*da i*	,,	*dai.*	,,	*su l'*	,,	*sull'.*
,,	*da lo*	,,	*dál-lo.*	,,	*su gli*	,,	*sú-gli.*
,,	*da l'*	,,	*dall'.*	,,	*su la*	,,	*súl-la.*
,,	*da gli*	,,	*dá-gli.*	,,	*su le*	,,	*súl-le.*
,,	*da la*	,,	*dál-la.*	,,	*per il*	,,	*pél.*
,,	*da le*	,,	*dál-le.*	,,	*per i*	,,	*pei(pé').*
,,	*in il*	,,	*nél.*	,,	*per gli*	,,	*pé-gli.*

Per, generally speaking, is not contracted with an article commencing with the letter *l*, and in such cases it is customary to place *per* and such an article separately; as *per lo pas-sá-to*, for the past, etc.

In Italian, as in English, the nouns have no terminational alteration in either number; that is to say, all cases are alike. Strictly speaking, therefore, they cannot be said to have any declensions. All changes in Italian nouns denote only a difference in gender or in number. For example: *pás-se-ro*, sparrow, not only denotes the object *sparrow*, but also that it is a male; and *pás-se-re* (female), sparrows, not only denotes the feminine, but the plurality of number. The article in Italian, as in French, Spanish, and English, does not in itself denote the case, but is a word that distinguishes one noun as a determined object from another noun of the same class. It is on this account a fixed principle of the language never to place the article before a noun, when the latter is used in its general and indeterminate signification. The articles *il*, *lo*, and *la*, are in themselves as indeclinable as the noun itself. They only change according to the gender and number of the noun; and when the Italians desire to denote cases, they must, on this accou ke the English, place before the articles certain words, which are the substitutes of those inflections by which, in the Greek, Latin, and German languages, the cases are expressed. The English have only two such signs of cases—the words *of* and *to*. The Italians have three: *di*, for the second case, or genitive; *a*, for the third case, or dative; and *da*, for the sixth case, or ablative. These three words, *di*, *a*, and *da*, are used in the singular as well as in the plural, before masculine nouns as well as feminine. In the first case, or nominative, and in the fourth case, or accusative, the Italian noun has, as well as the English, no case-sign before it, and both these cases are sufficiently distinguishable by the place which they take before or after the verb, for which reason they require no special distinguishing mark.

Most Italian nouns, masculine and feminine, change their final vowel into I *in the plural:* as, *il pá-dre*, the father, *i pá-dri*, the fathers; *il po-ê-ta*, the poet, *i po-ê-ti*, the poets; *il cêr-vo*, the stag, *i cêr-vi*, the stags; *la má-dre*, the mother, *le má-dri*, the mothers; *la má-no*, the hand, *le má-ni*, the hands.

The most important exceptions *from this rule are feminine nouns terminating in* A, *which form their plural by changing* A *into* E: as, *la so-rêl-la*, the sister, *le so-rêl-le*, the sisters.

BOTANY.—XXIII.

[*Continued from p.* 111.]

BRYOPHYTA OR MUSCINEÆ—CHARACEÆ.

THOUGH not possessing the obvious beauties of the ferns, and though distinctly lower in organisation, the mosses and their allies play perhaps a more important part in the economy of Nature. As they now form the bulk of the peat in the bogs of temperate climates; so, though no trace remains of their perishable structure, they may have contributed largely to the accumulation of our seams of coal in a vastly more remote age; and by their growth and decay they often furnish the first soil that adheres to the previously bare rocks of our mountain-heights, and so facilitate the germination of the seeds of higher plants.

As we saw in the last lesson, the Bryophyta agree with higher groups in having a distinct stem and leaf (though the former is in one subdivision not like a typical stem), so that this sub-kingdom has been classed with phanerogams and pteridophytes under the name *Cormophyta*. We also saw that they agree with gymnosperms and pteridophytes, in having a distinct archegonium, and have, therefore, been united with those groups under the name *Archegoniatæ*. And, lastly, we saw that, though they agree with pteridophytes in presenting a marked alternation of generations, they are contrasted with that sub-kingdom as to the relative size and importance of the two stages. The ***Bryophyta***, or, as they are often called, ***Muscineæ***, develop, moreover, no true vascular tissue, but are entirely cellular.

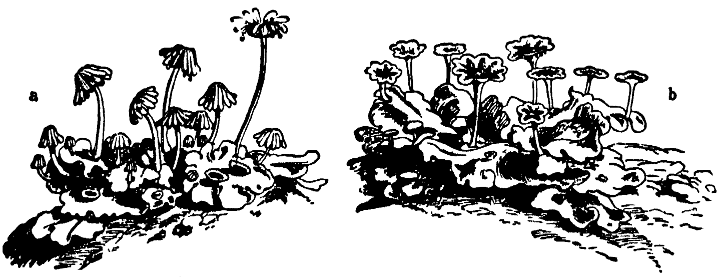

Fig. 94.—Liverwort (*Marchantia polymorpha*).
a, Thalloid stem with female branches; *b*, with male branches.

The spore in this group—and they are all isosporous—has two coats, like a pollen-grain—an exospore with projecting lines or points on it and an endospore—and contains chlorophyll corpuscles, besides protoplasm, starch, and oil On germinating it either produces the sexual generation or oophore directly, or indirectly by forming a filamentous pro-thallus or *protonema*, as it is termed, of branched rows of cells from which buds arise, either laterally or terminally, and develop into the oophores This oophore is rich in chlorophyll and is self-supporting, being either a flattened "thalloid" structure (Fig. 94), or having a filiform stem with distinct leaves (Fig. 95). The oophore bears antheridia and archegonia either on the same (monœcious) or on different (diœcious) individual plants.

The antheridium is spherical, ellipsoid, or club-shaped with a stalk, and consists of an outer wall or sac one layer of cells in thickness, with numerous small spermatocytes within (Fig. 96, *an*). The antheridium bursts at its apex, and the antherozoids escape from their mother-cells, the spermatocytes The antherozoid is spirally twisted with a thicker posterior extremity formed from the nucleus of the mother-cell, and two long delicate cilia at its pointed anterior extremity.

The archegonium (Fig. 96, *ar*) is flask-shaped, having a venter, generally two cells thick, enclosing the central cell, and a long neck, much longer than in Pteridophyta. The lower part of the central cell is separated off as the oosphere or ovum; and from the upper part, or *ventral canal cell*, a row of cells, the ***canal cells***, extends up through the neck. The uppermost cells of the neck are termed ***stigmatic cells*** or *lid cells*. The canal cells become mucilaginous, force apart the stigmatic cells, and so enable the antherozoids to penetrate to the oosphere. Each antheridium or archegonium originates from a single cell, and so may be a trichome in origin, though their position suggests in certain cases their being leaves or even branches.

The fertilised oosphere acquires a cell-wall, and is then known as an *oospore*, and undergoes repeated cell-divisions, forming an ovoid *embryo*. There is no suspensor. The embryo grows at its apex, *i.e.*, towards the neck of the archegonium, and the venter enlarges to permit its increase in size, but in most cases ultimately bursts, forming a cup-shaped *vaginule* or *epigone*, and sometimes also a cap-like *calyptra*. The apex of this calyptra is the neck of the archegonium.

Meanwhile the embryo develops into an independent structure, the "fruit" or *sporogonium*, which is, in fact, the asexual spore-producing generation or sporophore, and, though partly embedded in the tissue of the oophore and nourished by it, is only, so to speak, parasitic upon it. In the same way the embryo in a grain of corn lies in contact with, and is nourished by, the albumen of the seed, without being organically united to it. Within this sporogonium, which is thus a mere appendage of the oophore, the spores originate in fours from the division of *spore-mother-cells*.

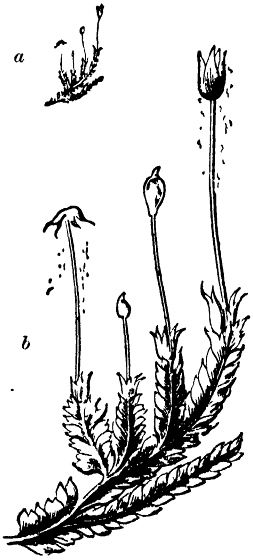

Fig. 95.—*Jungermannia heterophylla.*
a, Natural size, *b*, enlarged

Besides this alternation of generations, most bryophytes increase freely by purely vegetative processes. The thallus or leaf-bearing stem generally continues to grow, either at its apex, or by new shoots called *innovations*, while the older parts die off behind; and, as root-hairs or *rhizoids* are freely produced, branches may thus become independent plants. In mosses rhizoids may become protonema,

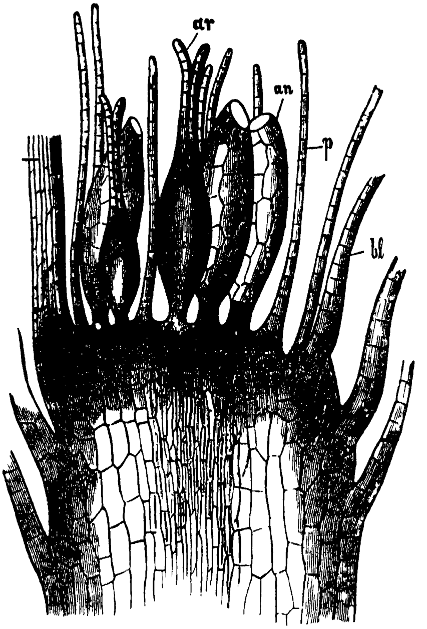

Fig. 96.—"FLOWER" OF A MOSS (*Bryum*).
ar, archegonium; *an*, antheridium; *p*, paraphysis, *bl*, leaf.

and protonema-threads may be developed from leaves or even from parts of the sporogonium. *Gemmæ*, or small cellular masses becoming detached and capable, like bulbils, of reproducing the plant, occur in most bryophytes; and it is more especially from these vegetative processes of reproduction that plants of this group occur "socially," *i.e.*, in extensive patches of one species.

There is very little differentiation of tissue in the **Bryophyta**; none at all in some of the lower forms. The stems of the higher types have a thickened cortical layer, and in some cases a central bundle of elongated cells, from which bundles of narrow cells may extend into the leaves. The leaves are sometimes only one layer of cells in thickness, but may have a "mid-rib" of several layers.

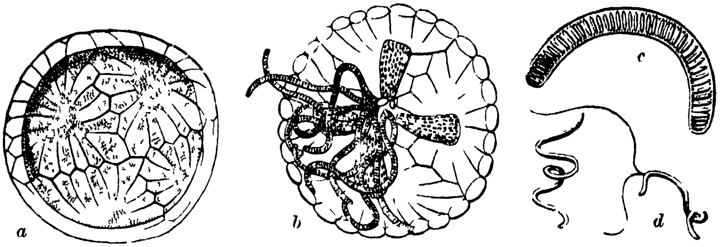

Fig. 97.—GLOBULE OR ANTHERIDIUM OF *Chara*.
a, The four upper shields; *b*, interior; *c*, antheridial filament; *d*, two antherozoids.

The Bryophyta fall into two fairly distinct classes, if we disregard for the present the remarkably isolated group of the *Characeæ*, the stoneworts, the exact systematic position of which is still undetermined. These two classes are the ***Musci***, or mosses, and the *Hepaticæ*, or liverworts. In mosses the protonema is comparatively large and permanent; the oophyte is a filiform stem, bearing leaves, and branching monopodially, if at all; the sporophyte ruptures the archegonium near its base so as to carry up a large part of it as a calyptra; and the sporogonium or capsule contains generally a large central mass or *columella* of sterile tissue, only one layer of cells producing the spores. In the liverworts, on the other hand, the protonema is usually small and unimportant; the oophyte is generally prostrate and distinctly dorsiventral, presenting, that is, a contrast between its upper and under surface; it is often flat and dichotomously branched (Fig. 94), though it may be filiform and leafy (Fig. 95); the archegonium remains mainly as a sheath or *vaginule* at the base of the stalk of the sporogonium; and there is no columella, all the cells in the interior of the capsule forming spores, or some of them forming *elaters*, long fusiform cells with spiral thickening-bands on the inner surface of their walls, the function of which is to separate the spores on the bursting of the capsule. As the *Hepaticæ* are in many respects more lowly organised than the *Musci*, we shall, in accordance with our previous practice, deal first with the latter or higher group.

In mosses the spores are round or tetrahedral in form, with a delicate cuticle or exospore, yellow, brown, or purple, concealing the chlorophyll within. They vary in diameter from $\frac{1}{125}$ down to $\frac{1}{5000}$ of an inch. They often retain the power of germination for a considerable time. In germinating the endospore grows out as a long tube or *protonema*, which divides by oblique transverse walls, and puts out branches immediately behind the septa, which branches again. The protonema develops chlorophyll where it is above ground, and may persist and continue to grow indefinitely, unlike the general transitory character of the prothallus in ferns. In *Sphagnum*, the bog-moss, and some other cases, the protonema varies in an interesting manner according to its surroundings, consisting of branching filaments if in water, but of a flat expansion like a prothallus if on land. The endospore of one spore may form two protonema-tubes, or it may form one only, sending downwards from its other side a transparent *rhizoid* or root-hair, which differs generally from protonema-threads by containing no chlorophyll, but by no constant characters. On short branches of the protonema buds are formed, by several oblique walls from either side of the tube, which give rise in the first instance to an *apical cell*, consisting usually of a three-sided pyramid with a convex basal surface outwards. From these buds arise the stems with leaves in two, three, five, eight, or more orthostichies. In the stem there may be merely a thickening and red colouration of the outer layers of cells; or there may be as well a central bundle of very narrow and very thin-walled cells, a rudimentary, vascular bundle, as it were (Fig. 96); or similar bundles may also occur running obliquely towards this central one from the leaves. The stem, though tough and durable, and sometimes a foot long, seldom exceeds $\frac{1}{25}$ of an inch in diameter. Its branching is never dichotomous or axillary, the branches springing from below certain leaves. Some forms have branch-systems much resembling pinnate leaves; and in others (*Acrocarpi*) sexual organs are produced at the apex of the main axis, and a lateral shoot or innovation arising below, a sympodium is formed. Creeping stolons are common.

The leaves of mosses are simple, sessile, and broad-based, developed basipetally from an apical cell, and generally acute. Some few mosses have leaves of two sizes in distinct rows. The leaf is commonly only one cell thick except along its midrib, all the cells containing chlorophyll; but in *Leucobryum*, *Sphagnum*, and *Polytrichum* we have more complex structures. In the first-named there is an upper and a lower layer of large cells, containing only air and water, with perforations in their walls, and between them are cells containing chlorophyll. This gives the plant a whitish appearance. In the bog-mosses (*Sphagnum*) the leaf is only one cell thick, but some of the cells are large, perforated, spirally thickened, and colourless, whilst between them are smaller ones united in a network and containing chlorophyll. These perforated colourless cells form a capillary apparatus by which the plant is filled with water like a sponge, even though high above the level of the water in the bog. In *Polytrichum*, a genus including some of the largest and most highly organised mosses, most of the leaf is two cells thick, and from its upper surface rise numerous plates, each about four cells high, running from its base to its apex, and containing the chlorophyll.

No group of plants has so great and so varied means of vegetative multiplication as mosses. Rhizoids, leaves, and even parts of the sporogonium, can produce protonema threads, which in turn bear leafy stems, and several groups also produce *gemmæ*, cellular masses on stalks, which are sometimes (*Bryum*) axillary, sometimes collected in a special leafy cup on a special branch or *pseudopodium*. These gemmæ produce a protonema, the formation of which, in fact, always precedes that of leaf-bearing axes.

The "flower" of the moss (Fig. 96), as it has not untruly been called, may terminate the primary axis (*acrocarpous*) or certain secondary axes (*pleurocarpous*). It is surrounded by an envelope (*perichætium*) of delicate leaves, and is either bisexual, monœcious, or diœcious. Amongst the archegonia and antheridia there are generally multicellular hairs or scales known as *paraphyses* (Fig. 96, *p*), with cuticularised, orange cell-walls, whose sole function appears to be the retention of water to facilitate fertilisation.

The fertilised oosphere undergoes cell-division, forming an embryo which, as it enlarges, is termed the *sporogonium*, *sporophore*, or *sporophyte*. It is embedded at its base (foot) in the tissue of the stem, but is a distinct generation, and is only in mechanical contact, not with any continuity of tissue, with the stem. Its lower portion commonly elongates into a stalk or *seta*, its upper part forming the "capsule" or *theca*. The main mass of the archegonium is generally torn from its base by the growth of the sporogonium, and carried up as a cap-like *calyptra* over the theca, whilst the growth of the stem below the archegonium forms the sheathing *vaginule*. In *Sphagnum*, however, the seta is very short, but the stem elongates into a long seta-like *pseudopodium* below the vaginule.

The capsule has a wall several cells thick, sometimes having stomata on its surface, the only part of the moss on which they occur. In structure and in the mode of dehiscence it differs considerably in the four orders into which mosses are divided, *Sphagnaceæ*, *Andreæaceæ*, *Phascaceæ*, and *Bryaceæ*. In *Sphagnum*, the only genus in the first order, the calyptra is torn irregularly, the capsule and its columella are globular, the spores are produced by a hemispherical layer of cells over the upper half of the latter, and the capsule bursts by the removal of a small lid or *operculum*. The stem in *Sphagnum* has several cortical layers of colourless perforated cells like those of the leaf.

The *Andreæaceæ* are small mosses with a pseudopodium like *Sphagnum*, but with a long capsule and pointed calyptra like the *Bryaceæ*. The columella and sporogenous layer resemble those of *Sphagnum*, but the capsule dehisces, by four lateral longitudinal slits, into valves united above and below. The *Phascaceæ* are also minute, and are distinguished by having capsules which do not dehisce, but merely decay.

The *Bryaceæ*, or true mosses, have almost always a long seta, a cap-like calyptra, and an operculum below it. Between the walls of the capsule and the *spore-sac* or sporogenous layer is an intercellular space crossed by strands of green cells, and the central columella extends to the summit of the capsule, widening out beneath the operculum. The operculum is thrown off in some cases by the swelling of a circle of thick-walled epidermal cells called the *annulus;* and round the mouth of the capsule are then usually disclosed a *peristome* or row of *teeth*, consisting of thickened walls of disorganised cells. In *Polytrichum* there is an enlargement of the seta, or *apophysis*, below the capsule, an inner intercellular space between the columella and the spore-sac, crossed, like the outer one, by green cell-filaments, and a layer of cells or *epiphragm* remains stretched across the mouth of the capsule from the points of the peristome-teeth after the columella has dried up. The ripe spores can fall out between the peristome-teeth.

Whilst mosses may occur in water or on dry rocks or on tree-trunks, liverworts are practically confined to damp shady spots. Though there are intermediate forms, liverworts fall mainly into two groups differing in habit, the *foliose* and the *thalloid* or *frondose*, both of which agree, however, in general, in being dorsi-ventral, growing, that is, in a more or less prostrate manner and presenting a contrast between the structure of their upper and under surfaces.

The foliose type, represented by the genus *Jungermannia* (Fig. 95), have a slender stem with a three-sided apical cell, and generally three rows of leaves, two lateral, and the third, of smaller leaves, on the under or ventral surface. All these leaves are simple cell-surfaces, with no midrib. The ventral leaves, or *amphigastria*, are sometimes absent. The sexual organs are produced monœciously or diœciously near the apex of main shoots or of short special branches, the antheridia singly or several together in the axils of leaves lower down, and the archegonia, usually in numbers, at the apex of the shoot. The antheridium consists of a stalk and a spheroidal body, the latter having a wall of one layer of cells containing chlorophyll, and being filled with numerous small spermatocytes. When the antheridium bursts these spermatocytes escape at intervals, and each emits a once, twice, or thrice coiled antherozoid with two cilia. The archegonia are surrounded by perichætial leaves, and usually by an inner membranous investment round each of them called a *perigynium*. In structure and development they resemble those of mosses, having a venter with a wall one or two cells thick, oosphere and ventral-canal-cell, and a long neck of five or six rows of cells, the upper tier of which, or *stigmatic cells*, separate so as to permit the antherozoids to find their way through the mucilaginous neck-canal-cells. In the sporophore stage the archegonium remains round the base of the sporogonium as a vaginule, no calyptra being formed; there is often a long seta; and the capsule has merely a wall of one layer of cells, and, as a rule, no columella. Whilst some of the cells in the interior give rise to spores, others become long and fusiform, with one, two, or three brown spiral thickening bands, and are known as *elaters*. These seem to assist in dispersing the spores when the ripe capsule splits into four lobes. They are, of course, quite dissimilar in origin to the structures known by the same name in the Equisetaceæ. The spores are unicellular, and in germination give rise to a thalloid *protonema*, a cell-surface, from buds on the margin of which the leafy stem of the oophore springs.

The thalloid forms, or liverworts, represented by the common genus *Marchantia* (Fig. 94), often seen on damp brickwork or conservatory floors, branch dichotomously, and have sometimes a "mid-rib" of elongated cells. In *Marchantia* the upper surface of the thallus-like stem is divided up into diamond-shaped spaces or *areolæ*, the epidermis in each of these forming the roof of an air-space, and having in its centre a projecting stomate. These stomata are surrounded by four or five tiers of guard-cells with from four to six cells in each tier. From the bottom of the air-cavities rise branching chains of rounded cells containing chlorophyll. The lower part of the thallus consists of colourless cells, without interspaces, slightly elongated horizontally, and often with reticulately-thickened walls. Scale-like leaves and unicellular rhizoids spring from the under surface. Near the growing point of the stem in most species hairs are developed which, by an alteration of part of their cell-walls, excrete mucilage, and so preserve the growing parts from the danger of being dried up in drought.

In addition to the development of adventitious branches, the formation of *gemmæ* is a frequent mode of vegetative multiplication among the

Hepaticæ. In *Marchantia* cup-shaped receptacles are formed on the upper surface of the thallus, from the bottom of which papillæ, hair-like in origin, arise, and by cell-division form flat cell-masses or gemmæ. Mucilaginous hairs occur between them and serve to detach them. *Lunularia* is named from its receptacles being similar, but crescent-shaped. On whichever side they fall, on reaching the ground, these gemmæ give rise to a dorsi-ventral thallus like that which produced them.

The sexual organs are borne monœciously or diœciously, sunk in the tissue of branches on the dorsal surface of the thallus. In *Marchantia* the antheridia, which otherwise resemble those of *Jungermannia*, are each sunk in a cavity in the upper surface of an obconic branch with a lobed margin to this upper surface. The female branches in the same genus elongate after fertilisation. They are slender, but terminate in an umbrella-like disk with leaf-like lobes round its margin. From beneath these hang the perichætial leaves and archegonia. The form, development, and fertilisation of the archegonium and sporogonium is much as in *Jungermannia*, though the latter has but little seta. It contains both spores and elaters. Some species of the genus *Riccia* float on the surface of ponds.

This is, perhaps, the best place to speak of a very interesting but isolated group of plants, the *Characeæ*, sometimes known as stoneworts. They grow submerged in fresh or brackish waters all over the world, and their chlorophyll is often so masked by a surface incrustation of carbonate of lime as to give them a greyish colour, and the brittle stoniness that has suggested an English name for them. Their slender stems are often several feet in length, are rooted in the mud by rhizoids produced from their lower nodes, and have whorls of leaves and branches. They are thus truly cormophytic. On the other hand, so simple is the cellular structure of both stem and leaf, and so large the cells, that the group are constant favourites with the microscopist and the biological investigator, who is often led to class them rather with green algæ than with any higher group. The stem and the leaf are each terminated by a large apical cell which divides horizontally (transversely). Of the cells thus formed from its basal half, each alternate one is an *internodal cell*, elongating, sometimes to a length of several inches, but not again dividing, whilst the others or *nodal cells* do not elongate much but divide vertically (longitudinally). The node comes to consist of a whorl of cells each of which produces a leaf. There are two main generic types in the order, *Chara* and *Nitella*. In *Nitella* the internodal cells are not covered by any other structure, whilst in *Chara* from the base of each leaf an outgrowth, similar to the stem or to the leaf itself, in having apical, nodal, and internodal cells, grows downwards, and another upwards, so that the internodal cell is surrounded by a so-called *cortical tissue*. A torsion of the internodes gives this tissue a spiral character. The leaves have much the same structure as the stem, having nodal, internodal, and cortical cells and branching, but the number of cells is limited, and the apical cell is pointed. The branches are axillary.

The protoplasm in the cell soon becomes vacuolated until it forms merely a primordial utricle or lining to the cell-wall. In this two layers are distinguishable, an outer motionless *ectoplasm*, to which the numerous multiplying chloroplastids adhere, and an inner glassy *endoplasm*, which during life exhibits rapid rotatory motion, travelling up one side of the cell and down the other. The line of contact between the ascending and descending currents is a motionless *neutral line*, free from chloroplastids.

Some species produce starchy tuber-like *bulbils* at the nodes. The sexual organs are borne on the leaves either monœciously or diœciously, and are unlike, in many important characters, those of any other plants. The antheridium or *globule* is spherical, with a unicellular *pedicel*. Its wall is composed of eight cells or *shields*, with radiate folds of their cell-walls extending towards their centres. The four lower ones (round the pedicel) are four-sided; the four upper ones, triangular (Fig. 97, *a*). From the centre of each of these shields there projects toward the centre of the globule a cylindrical cell called the *handle* or *manubrium*. At the inner end of each manubrium is a round cell, the *capitulum*, bearing six smaller *secondary capitula*, and from each of these proceed four long coiled-up filaments (Fig. 97, *b*). These filaments, of which there are thus 192, consist of a chain of from 100 to 200 spermatocytes, each giving rise to an antherozoid, the form of which is one of the characters in which the *Characeæ* most nearly resemble the Bryophyta (Fig. 97, *d*). The shields contain chlorophyll, which turns red before the antheridium bursts.

The archegonium or *nucule* consists of a modified leaflet. It has an internodal cell for *pedicel*, above which is a nodal cell giving rise to a whorl of spirally-twisted cortical cells or envelope-tubes. The nodal cell is succeeded above by an ovoid apical cell, the *central* or *germ cell*. The envelope-tubes, which are rich in chlorophyll, end above, in *Chara*, in five small cells, called the *crown*. In *Nitella* there are two small crown-cells on each tube instead of one. These crown-cells separate so as to admit the antherozoids, and the wall of the central cell becomes mucilaginous. After fertilisation the contents of the central cell (*oosphere*) acquire a cellulose wall (*oospore*), the chloroplastids in the envelope-tubes become reddish-yellow, and the inner walls of these tubes become lignified and black. The whole nucule then falls off.

In germinating in the next season the oospore does not directly reproduce the leafy plant or oophore, but forms a cell-filament or *pro-embryo ;* one node of which gives off rhizoids, and the next bears some leaves and a bud which does develop into the next oophore stage. Though there is no asexually-produced spore, there is some suggestion of an alternation of generations in which the oophore is the conspicuous leafy plant, as in mosses.

ELOCUTION.—VIII.

[Continued from p. 106.]

IX.—JUST STRESS.

THE next characteristic of good reading and speaking is just "stress." This word is meant to designate a peculiar modification of force, which distinguishes speech from music. A long-drawn musical sound has its most forcible part—in consequence of "swell" and "diminish"—at the middle portion of the note. The tones of speech, on the contrary—although, in a few cases, they approach to this mode of voice—usually have the chief force of each sound at the opening or the closing part. In music, the increase of force is comparatively gradual; in speech and reading it is frequently abrupt. To these distinctive modes of voice the term "stress" is applied.

To understand the application of this term in detail, it becomes necessary to advert to the mode of creating vocal sounds. In vocal music the result is obtained by full "inspiration" (inhaling or drawing in the breath), and comparatively slight "expiration" (giving forth the breath). In this mode much breath is drawn in, much retained or withheld, and little given out at a time; and thus are produced these smooth, pure, and gradually increasing tones which are appropriate to music—all the breath that is given forth being converted into sound, and none escaping that is not vocalised. In notes of very short duration, singing and speech are, it is true, brought nearer to a resemblance. But this resemblance is more apparent than real, as may be observed in the execution of every good singer, which, in the most rapid passages, still produces the genuine effect of song, as differing from speech. The resemblance is owing solely to the brevity of sound, in such cases, which does not afford time for broad and marked distinctions to be drawn by the ear.

The modes of voice which constitute speech, or are exemplified in reading, are the following:—

I. RADICAL STRESS.—This form of force includes two modes—"explosion" and "expulsion."

1. "Explosion" is an abrupt and instantaneous burst of voice—as, for example, in violent *anger*.

This being an instinctive, unconscious, involuntary, impulsive emotion, does not allow time or disposition for any intentional or deliberate effect, but makes the creation of vocal sound seem an irrepressible, spontaneous, electric production of nature, lying equally out of the reach of the understanding and the will. This tone has its contrast in the deep, calm, and regular swell of the tone of *reverence*, or the ample volume, and deliberate force, of conscious *authority* and *command*, in which the speaker is self-possessed and self-directed, and controls his vocal effects for purposes understood or felt.

Contrast, for instance, the following angry shout of Douglas, when enraged by the defiance of Marmion, with the examples of *reverential invocation* and *authoritative command* which occur in the subsequent paragraphs.

Example of "Explosion."

UP DRA'WBRIDGE! GROOM! What, WARDER, HO'!
Let the PORTCULLIS FALL!

The sounds of all the accented vowels, in this style, fall upon the ear with an instantaneous, clear, sharp, abrupt, and cutting force, at the initial or "radical" part of each.

2. "Expulsion"—a conscious, intentional, and deliberate force, coming upon the ear with great power; as, for example, in the language of *authoritative command.*

Example of "Expulsion."

Vànguard! to right and left the front unfòld!"

In this style, bold and forcible as it is, and even sudden as is its commencement, the accented vowels do not startle the ear with the abrupt shock of the tone of anger, exemplified above. There is a partial, though very brief, swell perceptible in the "radical," or initial part of each sound. Both of the preceding examples are classed under the head of "radical" stress; as their chief force lies in the "radical," or first part of each sound.

II. MEDIAL STRESS.—This mode of force is exhibited in

1. "Effusion"—a moderate, gentle, and gradual swelling of tone—as, for example, in the calm and tranquil utterance of *reverential feeling*, in which no disturbing impulse agitates or forces out the breath, but the voice, somewhat as in music, glides out, with a smooth effusive stream of sound,

enlarging as it flows, but never bursting out into irregular violence.

Example of "Effusion."

But chiefly Thou, O Spirit ! that dost prefer,
Before all temples, the upright heart and pure,
Instruct me, for thou knowest.

The "effusive" style avoids everything abrupt or sudden in the formation of sound, and swells gradually to its "acmé" (chief point), at the middle of each sound—in the manner of music; and from this point "diminishes," or decreases, to the close. This species of "stress" is accordingly denominated "medial," from the Latin word *medius*, the middle.

2. "Suppression"—a powerful force of "explosion" or "expulsion," kept down in the very act of giving forth the voice, and converted into the "medial" form, as in the case of a person communicating, in great earnestness of feeling, with another, standing at a distance, and yet exceedingly anxious not to be heard by a third person, still further off; or, as in the tone of extreme earnestness, uttered by the watcher in the chamber of a sick person.

Examples of "Suppression."

Hark ! James, listen ! for I must not speak loud. I do not wish John to hear what I am saying !
Step softly ! speak low ! make no noise !

This mode of voice may be termed a "half whisper"; it is the "aspirated" and "impure" tone, which lies half way between the ordinary tone of the voice and a whisper. It is caused by allowing a vast quantity of breath, not "vocalised," to rush out along with the sound of the voice. It is, in fact, "explosion," or "expulsion," merged, as it were, or drowned in a stream of "aspiration," and made to assume the style of "medial stress."

III. Vanishing Stress.—Besides the "radical," or initial, and the "medial," or middle, "stress," there is also a "vanishing," or final "stress," which begins softly, swells onward, and bursts out suddenly, and leaves off abruptly, at the very close of a sound, as in the jerking termination of the tone of *impatient feeling*.

Thus, in the language of maddened impatience, as uttered by Queen Constance in her frenzy of grief and disappointment at the overthrow of all her hopes for her son in consequence of the peace formed between France and England :—

Example of "Vanishing Stress."

War ! war !—no peace : peace is to me a war !

In tones of this class the voice withholds its force, and delays the explosion or expulsion till the last moment of the emphatic sound, and then throws it out with an abrupt, wrenching force, which resembles that of a stone suddenly jerked from the hand. This species of stress, as it lies at the "vanish," or last point of a sound, is termed the "vanishing stress."

IV. Compound Stress.—The designation of "compound stress" is applied to that mode of forming tones which throws out the force of the voice in such a manner as to mark, with great precision, the "radical" and the "vanish," or the beginning and the end, of each accented or emphatic sound.

Thus, in the tone of *surprise*, which is marked by a bold upward slide, beginning very low and ending very high, the voice strikes with peculiar force on the first and last points of the slide, in order to stamp it more distinctly on the ear, as the vehicle of intense emotion. A striking example again occurs in the language of Queen Constance, in the situation mentioned above, when overwhelmed with astonishment at the news she has just received :—

Example of "Compound Stress."

Gone to be married ! gone to swear a peace !
Gone to be friends !

V. Thorough Stress.—This designation is applied to that species of force which marks all the forms of "stress"—"radical," "medial," and "vanishing"—with intense power, on the same sound, so as to cause the character of all to be deeply felt, as in a bold *shout*, or any other very impressive form of voice, which indicates intense emotion.

Example of "Thorough Stress."

Awake ! arise ! or be for ever fallen !

In this shout of the arch-fiend to his fallen host, the tone, it will be perceived, is not that of mere volume or quantity, of mere loudness or physical force, as in the mechanical act of calling, or the voice of a public crier. It has the wide "falling inflection" of *authority* and *command*, and the forcible "radical" stress and "expulsive" utterance of *courage;* and to preserve the effect of all these, it must not only begin and close vividly, but exhibit a "medial" "swell," and a distinct "vanish." It must, in other words, give distinctive force and character to the beginning, the middle, and the end of each accented sound.

VI. Intermittent Stress, or Tremor.—The "tremor" (trembling), or "intermittent" stress, takes place in the utterance of all those emotions which *enfeeble* the voice, by their overpowering effect on feeling; as, for example, in *fear* and *grief*, and sometimes *joy*, when extreme. This mode of utterance characterises also the feeble voice of age, or the tone of a person shivering with cold.

Examples of the former will be found in the section on "Expressive Tones." Of the latter we have instances in the language both of the old woman and the farmer in Wordsworth's ballad, "Goody Blake and Harry Gill."

She prayed, her withered hand uprearing,
While Harry held her by the arm—
[*Tremor.*] { "*God! who art never out of hearing,*
Oh! may he never more be warm!"
No word to any man he utters,
Abed or up, to young or old;
But ever to himself he mutters,
[*Tr.*] "*Poor Harry Gill is very cold!*"

X. EXPRESSIVE TONES.

The word "tone," in elocution, may be used, as in music, to signify the interval which exists in successive sounds of the voice as they occur in the gamut, or musical scale. But it is commonly used as equivalent, nearly, to the term "expression" in music, by which is meant the mode of voice as adapted, or not adapted, to *feeling*. Thus we speak of the "tones" of passion—of a "false" tone—of a "school" tone.

Every tone of the voice implies—(1) a certain "force," or "quantity," of sound; (2) a particular "note," or "pitch"; (3) a given "time," or "movement"; (4) a peculiar "stress"; (5) a special "quality," or "character"; (6) a predominating "inflection." Thus, the tone of *awe* has "a very soft force," a "very low pitch," a "very slow movement," "medial stress," and "pectoral quality," or that deep murmuring resonance which makes the voice seem, as it were, partially muffled in the chest, together with a partial "monotone," prevailing at the opening of every clause and every sentence. All these properties belong to the natural utterance of *awe;* take away any one, and the effect of emotion is lost—the expression sounds deficient to the ear.

[xx]* *Example* 1. The bēll | strīkes | òne. We
[˳˳] tāke nŏ nōte of tīme,
[=] But from its lòss: to gīve it, thēn, a tŏngue,
[*m.s.*] Is wìse | in man. As if an àngel | spoke‖
[*p.q.*] I fēel the sŏlemn sòund. If hēard arīght,
● It is the knēll of my depārted hòurs.
Whēre àre they?—With the yēars beyŏnd the flòod.

The first five of the properties of voice which have been enumerated are the ground of the following classification and notation:—

KEY TO THE NOTATION OF "EXPRESSIVE TONE."

"*Force.*"

[|] "loud"; [||] "very loud"; [x] "soft"; [xx] "very soft"; [<] "increase"; [>] "decrease."

"*Pitch.*"

[°] "high"; [°°] "very high"; [˳] "low"; [˳˳] "very low."

"*Key.*"

[♯] "lively"—(full tone); [♭] "plaintive"—(semitone).

"*Time.*"

[‿] "quick"; [‿‿] "very quick"; [—] "slow"; [=] "very slow."

"*Stress.*"†

[*r.s.*] "radical stress"; [*m. s.*] "medial stress"; [*v.s.*] "vanishing stress"; [*c. s.*] "compound stress"; [*th.s.*] "thorough stress"; [*s. s.*] "suppressed stress"; [*tr.*] "tremor"; [*ef. s.*] "effusive stress"; [*expul. s.*] "expulsive stress"; [*explo. s.*] "explosive stress."

"*Quality.*"‡

[*h. q.*] "harsh quality"; [*sm. q.*] "smooth quality"; [*a. q.*] "aspirated quality"; [*pu. t.*] "pure tone"; [*p.q.*] "pectoral quality"; [*g. q.*] "guttural quality"; [*o. q.*] "oral quality"; [*oro. q.*] "orotund quality."

"*Combinations.*"

[*h. g. q.*] "harsh guttural quality"; [*sm. p. q.*] "smooth pectoral quality," etc.

The above Key, though at first sight intricate, will occasion no serious difficulty to students who have read attentively the Sections on "Stress" and "Quality." The notation will be found of great service, not only by suggesting appropriate "expression," which a young reader might otherwise overlook, but by enabling the pupil to prepare for the exercise of reading or declaiming, by previous study and practice.

It is a humiliating fact that, in many schools, the sublimest and most beautiful strains of poetry—take, for example, Milton's invocation, "Hail, holy Light!"—are, from the neglect of "expressive tone," called out in the same voice with which a clerk repeats the number or the mark on a bale of goods, or read with the "free and easy" modulation of a story told by the fireside; or, perhaps, with the pompous mouthing of the juvenile hero of a "spouting club," with the languishing tone of a sick person, or with the suppressed, half-whispering utterance of a conscious culprit.

The notation of "expression" has been adopted with a view to the early formation of correct habit.

RULES ON EXPRESSIVE TONE.

Rule 1.—The tones of *anger*, *vexation*, *alarm*, *fear*, and *terror* have an utterance "extremely loud, high, and quick," "abrupt," and "explosive,"—or sometimes marked by "expulsive" and by "vanishing" stress—an "aspirated," "harsh," and "guttural" voice, and are characterised throughout by the "falling inflection."

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* These marks indicate [xx] "very soft"; [˳˳] "very low"; [=] "very slow"; [*m s.*] "medial stress"; [*p.q.*] "pectoral quality."—See *Key to the Notation of "Expressive Tone."*

† *See* Section IX., "Stress." ‡ *See* Section x., "Quality."

Example of Anger.

He hath *disgràced* me, and hindered me of *half a million; laughed* at my *lòsses*, *mocked* at my *gàins*, *scorned* my *nàtion*, *thwarted* my *bàrgains*, *cooled* my *friends*, *heated* mine *ènemies*: and *what's his rèason?* I AM A JÈW. Hath not a *Jew èyes*, hath not a *Jew hánds*, *órgans*, *diménsions*, *sénses*, *afféctions*, *pàssions? fed* with the *same fóod*, *hurt* with the *same wéapons*, *subject* to the *same diséases*, *healed* by the *same méans*, *warmed* and *cooled* by the *same winter and summer* as a CHRÍSTIAN is?

Vexation.

Sáy you *so?* SÁY you so?—I say unto you again, you are a *shàllow*, *còwardly hìnd*, and you LIE. Our *plot* is a *good plot* as ever was *làid;* our *friends true and* CÒNSTANT; a GÒOD PLOT, *good friends*, and *full of expectation:* an ÈXCELLENT *plot*, VÈRY *good friends*. What a FRÒSTY-SPIRITED *rogue* is *this!*—An I were now *by* this rascal, I could *brain* him with his LADY'S FÀN.—*Oh!* I could DIVÌDE myself, and go to BÙFFETS, for moving such a DISH OF SKIMMED MÌLK with so *honourable* an *àction!*

Alarm.

Strike on the *tinder*, HÒ!
Give me a TÀPER; *call up all my* PÈOPLE!
Get MÒRE tapers;
Raise all my KÌNDRED!—
Call up my BRÒTHER!—
Some | ÓNE way, *some* ANÒTHER!
Get WÈAPONS, HÒ!
And *raise* some *special officers* of *night!*

Fear.

Oh! SÀVE me, *Hubert*, SÀVE me: my *eyes* are ÒUT,
Even with the *fierce* LÒOKS of *these bloody men!*
Alàs! what need you be so *boisterous róugh?*
I will not *strúggle*,—I will STAND | STÓNE | STÌLL.
For HÈAVEN'S sake, *Hubert! let* me not be BÓUND!
Nay, HÈAR me, *Hubert! drive these mén away*,
And I will sit as *quiet* AS A LÀMB;
I will not *stir*, nor WÌNCE, nor speak a WÒRD,
Nor LÒOK | upon the irons | *ángerly;*
Thrust but *these mén away*, and I'll FORGÌVE you,
Whatever torments you do put me to.

Terror.

AWÀKE! AWÀKE!—
RING the ALARUM BELL: MÙRDER! and TRÉASON!
BÀNQUO, and DONALBÀIN! MÀLCOLM! AWÀKE!
Shake off this *downy sleep*, death's counterfeit,
And look on *death itself!*—UP! UP! and see
The *great* DÒOM'S *image!*—MÀLCOLM! BÀNQUO!
As from your GRÀVES rise up, and walk like *sprites*,
To *còuntenance this horror!*

Rule 2.—*Wonder* and *astonishment* are expressed by "loud, high, and slow utterance"; "vanishing stress"; "aspirated" and slightly "guttural" "quality"; and prolonged "downward slide." *Astonishment* exceeds *wonder* in the degree of these properties.

Example of Wonder.

What is't?—a *spirit?*
Sèe! how it *looks abòut!* Believe me, sir,
It carries a *bràve form!*—but 't is a *spirit!*—
I might call him
A thing *divine;* for nothing *natural*
I ever saw so *nòble!*

Astonishment.

Alonzo. What hàrmony is *this!*—my *good friends*, HÀRK!
Gonzalo. Màrvellous sweet music!
Alon. Give us *kind kèepers*, HÈAVENS!—*What were* THESE?
Sebastian. A *living dròllery!* Now will I believe
That there are *ùnicorns:* that, in Arabia,
There is *one trèe*, the *phœnix throne; one phœnix*
At this hour *rèigning there.*
Antonio. I'll believe *bòth;*
And what does *èlse* want credit, come to *me*,
And I'll be *sworn 'tis* TRÙE.

Note—*Amazement*, when it does not go to the utmost extreme, has a louder, but lower and slower utterance than *astonishment;* the other properties of voice are of the same description as those expressed in astonishment, but increased in degree.

Amazement.

Gonzalo. I' the name of something hòly, sir, why stand you
In this *strange stàre?*
[$_{o}$] *Alonzo.* Oh! it is MÒNSTROUS! MÒNSTROUS!
Methought, the *billows* spoke, and *tòld* me of it;
The WÌNDS did sing it to me; and the THÙNDER,
That deep and *dreadful organ-pipe*, pronounced
The name of PRÒSPER; it did *bàss* my *trespass!*

Rule 3.—*Horror* and *extreme amazement* have a "softened" force, an extremely "low" note, and "slow" movement, a "suppressed stress," a deep "aspirated pectoral quality," and a prevailing "monotone."

Example of Horror.

Nōw, o'er ōne hālf the wōrld
Nāture sēems dèad; and wīcked drēams abūse
The cūrtained slēeper; witchcraft cēlebrates
Pāle Hēcate's ōfferings; and wīthered mūrder
Alārumed by his sēntinel, the wōlf,
Whose hōwl's his wātch, thūs with his stēalthy pāce,
With Tārquin's rāvishing strīdes, towards his design
Mōves like a ghost.—[$_{\infty}$] Thōu sūre and fīrm-set ēarth
Hēar not my stēps which wāy they wālk, for fēar
The vēry stònes prāte of my whēreabouts,
And tāke the prēsent hōrror from the time,
Which nōw suits with it.

Extreme Amazement.

Oh! ànswer me:
Let me not bùrst in ìgnorance! but tēll
Whȳ thȳ canōnised bōnes, hēarsed in death,
Have būrst their cèrements! whȳ the sēpulchre,
Wherēin we sāw thee quietly inūrned,
Hath ōped his pōnderous and mārble jāws,
To cāst thee ùp again! [$_{\infty}$] Whāt māy this mēan,
That thōu, dēad cōrse, agāin, in cōmplete stēel
Revīsit'st thūs the glimpses of the mōon,
Māking nīght hideous; and we fōols of nāture,
So hōrribly to shāke our dispositīon,
With thōughts beyōnd the rēaches of our sòuls?

GERMAN.—XXXIII.

[*Continued from p.* 116.]

THE NUMERALS.

IN German, as in other languages, the numerals are arranged into classes according to their signification—viz., *Cardinal*, *Ordinal*, *Distributive*, etc., as will be explained under their respective heads.

The Cardinal Numbers.

The cardinal numbers, whence all the others are derived, are those answering definitely to the question, "How many?" They are the following:—

Eins (ein, eine, ein)	1.	dreißig	30.
zwei	2.	ein und dreißig, ꝛc.	31, etc.
drei	3.	vierzig	40.
vier	4.	fünfzig	50.
fünf	5.	ſechzig (not ſechszig)	60.
ſechs	6.	ſiebenzig *or* ſiebzig	70.
ſieben	7.	achtzig	80.
acht	8.	neunzig	90.
neun	9.	hundert	100.
zehn	10.	hundert und eins	101.
elf	11.	hundert und zwei	102.
zwölf	12.	hundert und drei, ꝛc.	103, etc.
dreizehn	13.	zwei hundert	200.
vierzehn	14.	drei hundert	300.
fünfzehn	15.	tauſend	1,000.
ſechzehn	16.	zwei tauſend	2,000.
ſiebenzehn *or* ſiebzehn	17.	drei tauſend	3,000.
achtzehn	18.	zehn tauſend	10,000.
neunzehn	19.	hundert tauſend	100,000.
zwanzig	20.	eine Million	1,000,000.
ein und zwanzig	21.	zwei Millionen	2,000,000.
zwei und zwanzig, ꝛc.	22, etc.		

Observe that the cardinals are, for the most part, *indeclinable*.

Ein, *one*, however, is declined throughout like the indefinite article. It is, in fact, the same word with a different use, and is distinguished from it in speaking and writing only by a stronger emphasis, and by being usually written with a capital initial. This is the form which it has when immediately before a noun, or before an adjective qualifying a noun. Thus:—

Masculine.

Nom.	Ein Mann, one man.
	Ein guter Mann, one good man.
Gen.	Eines Mannes, of one man.
	Eines guten Mannes, of one good man.

In other situations, ein follows the ordinary rules of declension; thus in the—

(*a*) OLD FORM.

Nom.	Einer	eine	eines, one.
Gen.	Eines	einer	eines, of one, etc.

(*b*) NEW FORM.

Nom.	Der eine	die eine	das eine, the one.
Gen.	Des einen	der einen	des einen, of the one, etc.

(*c*) MIXED FORM.

Nom.	Mein einer	meine eine	mein eines, my one.
Gen.	Meines einen	meiner einen	meines einen, of my one, etc.

In relation to the numeral ein, note, further, these three things:—

That in merely counting, it has the termination of the neuter, with e, however, omitted; as:—Eins, zwei, drei, one, two, three, etc;

That ein may be used in the *plural* when the design is to distinguish classes of individuals, as:—Die Einen, *the ones*, Der Einen, *of the ones*, etc., just as in English we say, *the ones*, *the others*;

That ein, unlike the English *one*, cannot be employed so as to fill the place of a noun. Thus we cannot say in German, "A new *one*," "a good *one*," etc. In such cases, the adjective stands alone.

Zwei, *two*, and drei, *three*, when the cases are not sufficiently pointed out by other words in the context, are declined thus:—

Nom.	Zwei, two.	Drei, three.
Gen.	Zweier, of two.	Dreier, of three.
Dat.	Zweien, to *or* for two.	Dreien, to *or* for three.
Acc.	Zwei, two.	Drei, three.

In place of Zwei, beide (*both*), which is declined like an adjective in the plural, is often employed, as:—Beide Augen, both eyes; Die beiden Brüder, both the brothers. The neuter beides never refers to *persons*.

All the rest of the cardinals, when employed *substantively*, take -en in the *dative*, except such as already end in these letters, as:—Ich habe es Fünfen geſagt, I have told it to five (persons).

Hundert and Tauſend are often employed as collective (neuter) nouns, and regularly inflected, as: singular nom. das Hundert (the hundred), gen. des Hunderts (of the hundred), etc.; plural nom. die Hunderte (the hundreds), etc. Million (million) is, in like manner, made a noun (feminine), and is in the singular always preceded by the *article*, as:—Eine Million, a million.

In speaking of the cardinals *merely as figures or characters*, they are all regarded as being in the *feminine* gender, as:—Die Eins, the one; die Zwei, the two; die Drei, the three—where, in each case, the word Zahl (*number*) is supposed to be understood: thus, Die (Zahl) drei, the (number) three.

The Ordinal Numbers.

The ordinal numbers are those which answer to the question, "Which one of the series?" They are regularly inflected according to the rules already given for the declension of adjectives.

ORDINALS.

Der erſte, the first.	Der fünfte, the fifth.
" zweite, the second.	" ſechſte, the sixth.
" dritte, the third.	" ſiebente, the seventh.
" vierte, the fourth.	" achte, the eighth.

Der neunte, the ninth.
„ zehnte, the tenth.
„ elfte, the eleventh.
„ zwölfte, the twelfth.
„ dreizehnte, the thirteenth.
„ vierzehnte, the fourteenth.
„ fünfzehnte, the fifteenth.
„ ſechzehnte, the sixteenth.
„ ſiebenzehnte *or* ſiebzehnte, the seventeenth.
„ achtzehnte, the eighteenth.
„ neunzehnte, the nineteenth.
„ zwanzigſte, the twentieth.
„ ein und zwanzigſte, the twenty-first.
„ zwei und zwanzigſte, the twenty-second.
„ dreißigſte, the thirtieth.
„ ein und dreißigſte, the thirty-first.
„ zwei und dreißigſte, ꝛc., the thirty-second, etc.

Der vierzigſte, the fortieth.
„ fünfzigſte, the fiftieth.
„ ſechzigſte, the sixtieth.
„ ſiebenzigſte *or* ſiebzigſte, the seventieth.
„ achtzigſte, the eightieth
„ neunzigſte, the ninetieth.
„ hundertſte, the 100th.
„ hundert und erſte, the 101st.
„ hundert und zweite, the 102nd.
„ hundert und dritte, the 103rd.
„ zweihundertſte, the 200th.
„ dreihundertſte, the 300th.
„ tauſendſte, the 1,000th.
„ zweitauſendſte, the 2,000th.
„ dreitauſendſte, the 3,000th.
„ zehntauſendſte, the 10,000th.
„ hunderttauſendſte, ꝛc, the 100,000th, etc.

Observe that, in the formation of the ordinals from the cardinals, a certain law is observed: viz., from zwei (two) to neunzehn (nineteen), the corresponding ordinal in each case (dritte and achte excepted) is made by adding the letters -te, as:—Zwei, two; zweite, second; vier, four; vierte, fourth, etc. Beyond that number (nineteen), the same effect is produced by adding -ſte, as:—Zwanzig, twenty; zwanzigſte, twentieth, etc. Erſte is from eher (before).

Note, also, that der andere (the other) is often used in place of der zweite, but only in cases where two objects alone are referred to.

In compound numbers it must be observed that the last one only, as in English, bears the suffix -te or -ſte; but in this case the units usually precede the tens; thus, Der vier und zwanzigſte, the four and twenti*eth*.

We have also a sort of interrogative ordinal, formed from wie (how) and viel (much, many), which is used when we wish to put the question, "Which of the number?" as:—Der wievielſte iſt heute? what day of the month is to-day? Das wievielſte iſt es? how many does that make?

DISTRIBUTIVE NUMERALS.

The distributives, which answer to the question, "How many at a time?" are formed, as in English, by coupling cardinals with the conjunction und (and), or by using before them the particle je (ever, at a time). Thus:—

Zwei und zwei, two and two; *or* je zwei, two at a time.
Drei und drei, three and three; *or* je drei, three at a time; etc.

MULTIPLICATIVE NUMERALS.

The multiplicatives, which answer to the question, "How many fold?" are formed from the cardinals by adding the suffix -fach (fold) or -fältig (having folds). Thus:—

Einfach *or* einfältig,* onefold, *or* single.
Zweifach *or* zweifältig, twofold, *or* having two folds, *or* double.
Dreifach *or* dreifältig, threefold, *or* treble, *or* triple.
Vierfach *or* vierfältig, fourfold, *or* having four folds, *or* quadruple.

VARIATIVE NUMERALS.

Variatives, which answer to the question, "Of how many kinds?" are formed from the cardinals by affixing lei (a sort *or* kind), the syllable er being inserted for the sake of euphony. Thus:—

Einerlei, of one kind.
Zweierlei, of two kinds.
Dreierlei, of three kinds.
Mancherlei, of many kinds, etc.

DIMIDIATIVE NUMERALS.

The dimidiatives, which answer to the question, "Which (*i.e.*, which of the numbers) is but a half?" are formed from the ordinals by suffixing the word halb (half). Thus:—

Zweitehalb,† the second half (*i.e.*, one whole and a half), $1\frac{1}{2}$.
Drittehalb, the third half (*i.e.*, two wholes and a half), $2\frac{1}{2}$.
Viertehalb, the fourth half (*i.e.*, three wholes and a half), $3\frac{1}{2}$; etc.

ITERATIVE NUMERALS.

The iteratives, which answer to the question, "How often, *or* how many times?" are formed from cardinals and from indefinite numerals, by the addition of the word mal (time). Thus:—

Einmal, one time, once.
Dreimal, three times.
Jedesmal, each time.
Vielmal, many times; etc.

Mal is sometimes separated from the numerals, and is then regularly declined as a neuter noun.

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* Einfältig is also applied to what is *simple*, *artless*, or *silly*.

† Instead of zweitehalb, the word in common use is anderthalb; the part andert being from der andere, *the second*. The word *should* be anderehalb; but the final e is exchanged for a t, probably for the sake of assimilating it in *form* to the rest of the words of this class.

DISTINCTIVES.

The name *distinctives* is applied to a class of ordinal adverbs which answer to the question, "In what place in the series?" and which are formed by affixing -ens to the ordinal numbers. Thus:—

Erſtens, first *or* in the first place.
Zweitens, secondly.
Drittens, thirdly.
Viertens, fourthly.
Fünftens, fifthly.
Sechſtens, sixthly; etc.

Under the name distinctives may also be set down a class of numeral nouns, formed from the cardinals by the addition of the suffixes -er, -in, and -ling, which are used to designate "one arrived at, belonging to, or valued at a certain number." Thus:—

Sechziger, a sexagenarian, or one of a company of sixty.

Dreier, a threepenny piece, a coin of 3 pfennigs Prussian.

Elfer, wine of the year 1811.

willing, a twin, one of two.

PARTITIVES OR FRACTIONALS.

Under the name partitives are embraced a class of neuter nouns answering to the question, "What part?" which are formed by affixing to the ordinals the suffix -tel (part). Thus:—

Drittel, a third.
Viertel, a fourth.
Siebentel, a seventh.
Achtel, an eighth; etc.

Tel is a contracted form of the word Theil (a part). From 20 upwards, note that -ſtel (instead of -tel) is added, as:—Zwanzigſtel, the twentieth; etc.

INDEFINITE NUMERALS.

The indefinite numerals, which are, for the most part, used and inflected as adjectives, are commonly divided into such as serve to indicate Number, such as merely denote Quantity, and such, finally, as are employed to express both.

Those indefinite numerals which denote number only are the following:—

Jeder jede jedes, *each, every.*
Jeglicher -e -es, „ „ } Old and unusual forms of jeder.
Jedweder -e -es, „ „ }
Mancher manche, manches, *many a, many* (in the plural).
Mehrere, *several* (plural of mehr, *more*).

Those which are employed to denote quantity only are the following:—

Etwas, *some;* which is indeclinable.

Ganz, *the whole,* as opposed to a part; declined generally like an adjective. *In*declinable, however, when placed before neuter names of places and not preceded by an article or pronoun, as:—Ganz Deutſchland, all Germany; (with the article or pronoun preceding) Das ganze Deutſchland, the whole of Germany; Sein ganze Reichthum, his whole riches.

Halb, *half,* follows the same law in declension as the word ganz above.

Those denoting both number and quality are the following:—

Aller, alle, alles, *all*—applied to quantity in the singular only, as:—Aller Reichthum, all riches; alle Macht, all power; alles Gold, all gold; dieſes alles (not alle) will ich geben, all this will I give; welches alles, all which. Placed before a pronoun which is followed by a noun, the terminations of declension are often omitted, as:—All (for alles) dieſes Geld, all this money; all (for aller) dieſer Wein, all this wine. In the neuter of the singular, it often denotes an indefinite number or amount, as:—Alles, was reiſen kann, reiſet, all that can travel, do travel; Er ſcheint alles zu wiſſen, he seems to know everything. In the plural, the word denotes number, as:—Alle Menſchen, all men; an allen Orten, in all places. It is never used in the sense of *whole,* which is expressed by ganz, as:—Der ganze Tag, the whole day; nor is it followed, as in English, by the definite article, as:—Alles Geld (not alles das Geld), all the money. Finally, the phrases "all of us," "all of you," etc., are in German, Wir alle, we all, etc. The plural is used like our word *every,* as:—Ich gehe alle Tag, I go every day.

Einiger, einige, einiges, *some, few;* applied to number in the plural only.

Etlicher, -e, -es, *some;* synonymous with einiger.

Kein, keine, kein, *no, none;* declined like Ein, eine, ein, *one;* as:—Kein Vater, no father; keine Mutter, no mother; kein Kind, no child. When employed as a noun, it takes the old form of declension, as:—Keiner der alten Verehrer, none of the ancient worshippers.

Sämmtlicher, -e, -es, *entire.* } Regularly declined like
Geſammter, -e, -es, *whole.* } adjectives.

Viel, *much* (in the plural, *many*), when it expresses quantity or number, taken collectively, and is not preceded by an article or a pronoun, is not declined, as:—Viel Gold, much gold; but Das viele Gold, the quantity of gold. When applied to a number, as individuals, it is regularly declined—as, Vieler, viele, vieles, etc. Thus, Viele Männer ſind träge, many men are indolent; Er hat ſehr viele Freunde, und ich habe auch viele, he has a great many friends, and I have also a great many.

Wenig, *little* (in the plural, *few*), follows the same rules of inflection as viel above.

Mehr, *more,* } are indeclinable. For the plural
Weniger, *less,* } of mehr, however, see above.

Genug, *enough, sufficient;* never declined. Geld genug, money enough.

Nichts, *nothing.*

Lauter, *merely, only;* never declined. Lauter Kupfer copper only *or* nothing but copper.

PRONOUNS.

In German, as in other languages, will be found a number of those words which, for the sake of convenience, are employed as the direct representatives of nouns. These are the Pronouns. They are divided, according to the particular offices which they perform, into six different classes, viz.:—Personal, Possessive, Demonstrative, Determinative, Relative, and Interrogative.

TABLE OF THE PRONOUNS.

PERSONAL PRONOUNS.		POSSESSIVE PRONOUNS.	
Singular.	*Plural.*	*Singular.*	*Plural.*
Ich, I.	Wir, we.	Mein, my.	Unſer, our.
Du, thou.	Ihr, ye.	Dein, thy.	Euer, your.
Er, he.	Sie, they.	Sein, his.	Ihr, their.
Sie, she.	Sie, they.	Ihr, her.	
Es, it.	Sie, they.	Sein, its.	

DEMONSTRATIVE PRONOUNS.

Dieſer, this.
Jener, that.
Der, this *or* that.

DETERMINATIVE PRONOUNS.

Der, that, that one, he.
Derjenige, that, that person
Derſelbe, the same.
Selbiger, the same.
Solcher, such.

RELATIVE PRONOUNS.

Welcher, who, which.
Der, that.
Wer, who, he *or* she, who *or* that.

INTERROGATIVE PRONOUNS.

Wer? who? Was? what?
Welcher? who? which?
Was für? what sort of?

INDEFINITE PRONOUNS.

Man, one, a certain one.
Jemand, someone, somebody.
Niemand, no one, nobody.
Jedermann, everyone, everybody.

REFLECTIVE AND RECIPROCAL PRONOUNS.

Sich, himself, herself, itself, themselves.
Einander, one another.

PERSONAL PRONOUNS.

There are then five personal pronouns—namely, Ich (*I*), which represents the speaker, and is therefore of the *first* person; Du (*thou*), which represents the hearer, or person spoken to, and is therefore of the *second* person; and Er (*he*), Sie (*she*), Es (*it*), representing the persons or things spoken of, and therefore of the *third* person. They are declined thus:—

FIRST PERSON (ALL GENDERS).

	Singular.	*Plural.*
Nom.	Ich, I.	Wir, we.
Gen.	Meiner, mein, of me.	Unſer, of us.
Dat.	Mir, to me.	Uns, to us.
Acc.	Mich, me.	Uns, us.

SECOND PERSON (ALL GENDERS).

	Singular.	*Plural.*
Nom.	Du, thou.	Ihr, ye *or* you.
Gen.	Deiner *or* dein, of thee.	Euer, of you.
Dat.	Dir, to thee.	Euch, to you
Acc.	Dich, thee.	Euch, you.

THIRD PERSON (MASCULINE).

	Singular.	*Plural.*
Nom.	Er. he.	Sie, they.
Gen.	Seiner *or* ſein, of him.	Ihrer, of them.
Dat.	Ihm, to him.	Ihnen, to them.
Acc.	Ihn, him.	Sie, them.

THIRD PERSON (FEMININE).

	Singular.	*Plural.*
Nom.	Sie, she.	Sie, they.
Gen.	Ihrer, of her.	Ihrer, of them.
Dat.	Ihr, to her.	Ihnen, to them.
Acc.	Sie, her.	Sie, them.

THIRD PERSON (NEUTER).

	Singular.	*Plural.*
Nom.	Es, it.	Sie, they.
Gen.	Seiner, of it.	Ihrer, of them.
Dat.	Ihm, to it.	Ihnen, to them.
Acc.	Es, it.	Sie, them.

REMARKS ON THE PERSONAL PRONOUNS.

The genitives mein, dein, ſein, are the earlier forms. The others (meiner, deiner, ſeiner) are the ones now commonly used.

When construed with the prepositions halben, wegen, and um—willen (signifying "for the sake of," "on account of"), these genitives are united with the preposition by the euphonic letters et, or (in case of unſer and euer) simply t. Thus, Meinetwegen, on account of me; um unſertwillen, on account of us, etc.

The personal pronouns of the third person, when they represent things without life, are seldom, if ever, used in the dative, and never in the genitive. In such instances, the corresponding case of the demonstrative der, die, das is employed: thus, deſſen (of this), instead of ſeiner; and deren (of these), instead of ihrer.

The word ſelbſt or ſelber (self, selves) may also, for the sake of greater clearness or emphasis, be added not only to the pronouns, but even to nouns. Thus, Ich ſelbſt, I myself; die Leute ſelbſt, the people *themselves.*

Here, too, observe that the personal pronouns have also in the plural a reciprocal force. Thus, ſie lieben ſich, they love one another. But as ſie lieben ſich, for example, might signify "they love themselves," the Germans also use the word einander (one another), about which there can be no mistake: as, ſie lieben einander.

In polite conversation, the Germans use the *third* person plural where we use the *second;* thus, Ich habe Sie geſehen, I have seen you. To prevent misconception, the pronouns thus used are written with a capital letter; as, Ich danke Ihnen, I thank you. A similar sacrifice of grammar to (supposed) courtesy may be found in our own language, for we invariably use the plural for the singular: thus, "How are *you?*" instead of "How art *thou?*" The Germans proceed just one step beyond this, and, besides taking the plural for the singular, take the third person for the second. With them, our familiar salutation, "How do *you* do?" would be, "How do *they* do?"

It must be observed, however, that the second person singular (Du) is always, as in English, used in addressing the Supreme Being. It is also the proper mode of address among close friends and near relatives. The second person plural is employed by superiors to their inferiors. The third person singular (er, ſie) was used in the same manner—that is, by masters to servants, etc.

The neuter pronoun (es) of the third person singular, like the words *it* and *there* in English, is often employed as a nominative both before and after verbs, singular and plural, as a mere expletive —that is, more for the purpose of aiding the sound than the sense of the sentence. In this use, moreover, it is construed with words of all genders. Thus, Es iſt der Mann, *it* is the man; Es iſt die Frau, *it* is the woman; Es ſind Männer, *they* are men; Es donnert, *it* thunders; Es folgten viele, *there* followed many; etc.

When es is thus used with a personal pronoun, the arrangement of the words is precisely the reverse of the English, as:—Ich bin es, it is I; Du biſt es, it is thou; Sie ſind es, it is they; etc.

POSSESSIVE PRONOUNS.

The possessive pronouns are derived, each respectively, from the genitive case of the personal pronouns.

Note that in declining unſer and euer, the e before r is often struck out. Thus:—

Unſrer (for unſerer), unſre (for unſere), unſres (for unſeres), etc.

Eurer (for euerer), eure (for euere), eures (for eueres), etc.

By their forms, therefore, these pronouns indicate the person and number of the nouns which they represent—that is, the person and number of the ***possessors***. As, moreover, they may be declined like adjectives, they also make known by their terminations the gender, number, and case of the nouns with which they stand connected; for, in respect to inflection, a possessive pronoun agrees in gender, number, and case, not with the *possessor*, but with the name of the thing *possessed*.

The possessive pronouns, when conjunctive—that is, when joined with a noun—are inflected after the Old Form of declension, except in three places (nom. sing. *masc.* and nom. and acc. *neuter*), in which the terminations are wholly omitted, thus:—

	Singular.			*Plural.*
	MASC.	FEM.	NEUT.	FOR ALL GENDERS.
Nom.	Mein	meine	mein.	Meine, my.
Gen.	Meines	meiner	meines.	Meiner, of my.
Dat.	Meinem	meiner	meinem.	Meinen, to my.
Acc.	Meinen	meine	mein.	Meine, my.

When, however, these pronouns are absolute (that is, when they stand alone, agreeing with a noun understood and demanding a special emphasis) the terminations proper to the three places noted above are of course affixed. Thus, Dieſer Hut iſt meiner, nicht deiner, this hat is *mine*, not *thine;* dieſes Buch iſt meines, this book is *mine*.

But when a possessive pronoun absolute is preceded by the definite article, it then follows the New Form of declension.

Often, too, in this case, the syllable ig is inserted, but without any change of meaning.

When, finally, a possessive pronoun is employed as a predicate, and merely denotes possession, without special emphasis, it is not inflected at all. Thus, Der Garten iſt mein, the garden is mine; die Stube iſt dein, the room is thine; das Haus iſt ſein, the house is his.

It should be added that the Germans, when no obscurity is likely to grow out of it, often omit the possessive pronoun, where in English it would be used; the definite article seeming sufficiently to supply its place; as:—Ich habe es in den Händen, I have it in *the* hands (that is, I have it in *my* hands).

KEY TO TRANSLATION FROM GERMAN (p. 116).

THE REDBREAST.

A redbreast came in the severity of the winter to the window of a pious countryman, as though it wished to come in. Then the countryman opened his window, and took the confiding little creature kindly into his dwelling. It picked up the scraps and little crumbs which fell from his table. The children of the countryman also loved and cherished the little bird. But now, when the spring again came in, the land and the bushes were in leaf, the countryman opened his window, and the little guest flew away into the neighbouring wood, and built his nest and sang his merry little song.

And, behold! when the winter returned, the little redbreast came again to the house of the countryman, and had brought his little mate with him. Again the countryman, with his children, rejoiced very much when they saw both the little creatures, as they looked confidingly around out of their clear little eyes; and the children said: "The little birds look at us as if they wished to say something."

Then the father answered: "If they could talk, they would say, Kind confidence awakes confidence, and love begets return of love!"

COMPARATIVE ANATOMY.—I.

INTRODUCTION—TERMS EMPLOYED IN CLASSIFICATION—DIVISIONS OF THE ANIMAL KINGDOM.

THE simple instructions given by Linné to all succeeding naturalists were "Observe and compare." The Swedish naturalist, whom we call Linnæus, assiduously followed his own maxim, and became one of the greatest masters of the description, and the largest contributor to the science of the classification of living things whom the world has known.

All the higher animals are free, locomotive, well-defined individuals. Each has within the circumscribed limits of its body, whether that body be of moderate dimensions or extremely minute, every organ which is requisite to self-existence and reproduction. The actions which the body has to perform in order to carry on that orderly system of constructive change which is always associated with life, are very numerous. To perform these actions, many complex organs are required; hence an animal is a very compact piece of machinery, no part of which can be dispensed with without crippling the whole. As in a large factory every band, and wheel, and rod, from the great piston to the little bobbin, has its separate office, the adaptations to which have required thought and contrivance, so there is no part of any animal which is not fitted to carry out some necessary function.

The outward form of animals is often beautiful, and the study of it instructive; but it is obvious that we cannot expect to know anything of the animal, considered as a machine, until we have searched it throughout by cutting down to every internal organ, and examining all the peculiarities of each. If we neglect to do this, it is not only probable, but *certain*, that in the unexamined part we shall leave some secret of its life, some admirable contrivance, some wonderful adaptation, unnoticed. This leads us to the conclusion that in order to acquire a knowledge of living things we must use the knife. The microscope, the injecting syringe, and all the appliances of modern science may be used, but the knife or scalpel is indispensable, and the use of it has given a name to the science. The word *anatomy* is derived from the Greek ἀνά (*an'-a*), *through*, and τομή (*tom'-e*), *a cutting*. In following the Linnæan direction to *observe* in this realm of Nature, it was natural that the only means of observation should give its name to the science which sprang out of the investigation. At first, however, the study was directed upon one species only. If in more senses than one the proper study of mankind is man, it was natural that at first the human frame should monopolise all the attention of scientific dissectors. Hence the word *anatomy* was applied to the study of the structure of the human species. As science advanced, other animals were examined in the same way, and the new study, as it always suggested a comparison with the results of the old, was called *Comparative Anatomy*.

Comparative anatomy is a study of all the parts of all the different kinds of bodies which are found in the animal kingdom, so far as structure is concerned. Strictly speaking, it treats of the dead animal alone. It describes the machine when the motive power has ceased to act. Nevertheless, in examining the structure of a species it is quite impossible, and very undesirable, to exclude the idea of the function which the several parts have to perform when animated with life. Thus the twin studies of anatomy (or the structure of living beings) and of physiology are indissolubly connected, though distinct from one another. The mechanist has to do with the several parts of the engine while they are at rest, but every fitting is constructed with reference to motion. He cannot exclude the idea of motion while he is constructing his machine. He asks himself at every stage, Will it go? will it do its work well? The works of God cannot be constructed by man, and their simplest contrivances can scarcely be imitated; but man can examine and analyse them, and as he does so he will be continually asking himself, How does this structure act in the living animal? and exclaim, as knowledge dawns upon him, How admirably is this organ constructed to do its work!

The words *comparative anatomy*, however, suggest another truth—they suggest that living beings may be compared with one another. Every animal might be made a study by itself, as man has been. The fact that man's frame has been the subject of thousands of books, and the object of millions of investigations, and still affords unsolved problems, shows that the study of each species is almost unlimited. On comparing the bodies of different animals, it is found that they are not totally dissimilar structures. The first thing which strikes the student is that a very large number of animals are constructed upon the same ground-plan—they differ only in the details of their structure. Now, the details of structure are often most apparent on the exterior, while the essential plan lies deeper. The anatomist (*i.e.*, dissector) will often reveal a similarity between two animals which the zoologist would not suspect. If we take two animals so utterly dissimilar in size, outward form, and habits as the bat and the pig, and dissect them, we shall find that in the main they are alike. Not only is there a bony axis composed of many joints in the interior of the body of each, which supports the animal, gives origin to the muscles, and protects the nervous matter, but with few and slight exceptions we find bone for bone, muscle for muscle, nerve for nerve, in comparing each point of the internal structure of the two animals. Not only is the fore limb of a dog built upon the same plan as the arm of a man, but it is essentially more like it than it is to the hind limb of the same animal.

The similarity of structure which is found throughout a very large number of animals is the first fact which strikes every candid student of comparative anatomy. It is fortunate for the study that this is the case. If every animal were built up on an independent plan, no one could hope to gain a comprehensive view of the structure of the animal kingdom; nor would the study be so interesting, for the human mind delights in similitudes and generalisations; moreover, on this likeness of structure all classification of animals depends.

In pursuing his study, the comparative anatomist finds that while a very large number of animals are constructed after the same pattern, this pattern does not run through the structure of all animals. He finds another multitude of animals which are built upon a plan common to them all, but this plan is quite different from that which characterises the first group. When he has determined the number of these large groups, he finds farther that each species in one of these groups is not in the same degree like or unlike every other of the same group. If *a*, *b*, *c*, etc., represent a number of animals in a large group, he finds that *o* is not as like to *a* as *b* is to *a*, so that he can arrange them in something like order, placing one next to that to which it is most like, so as to show that though *z* be to a great extent unlike *a*, yet it is connected with it by the intermediate links. Our student will find also that each species is not in the same degree like or unlike even its next-door neighbour, as every other two next-door neighbours are. In other words, there are gaps in the series, and very useful these gaps are, because they enable us to split up the thousands of species which belong to each group into natural sections. The great groups themselves are only caused by very wide gaps; and these groups are subdivided by less marked gaps into smaller groups, and so on. The reader must always remember that the vast scheme of animated nature is far more complex than any of these poor illustrations express, or else he will be misled by that which was intended to explain it. Perhaps the best illustration of the relations of animals to one another is that of the richly branched head of a large tree. In summer, when the leafy covering presents an even surface to the eye, the connection of the ultimate twigs is not apparent; but in winter we can see that a number of twigs spring from one little bough, a number of these boughs spring from a branch, and a number of these branches may be traced down to where they diverge from the giant fork.

It follows from this arrangement that a great many things may be said about the structure of each animal in one group which will be true of all in that group. A great many more facts may be stated of the animals of a smaller group, and so on. Now these statements are the results of comparative anatomy, and the only true grounds of classification.

The comparative anatomist has a most difficult task before him, and the collected wisdom of all comparative anatomists has not saved them from many blunders; but every student of the science has this satisfaction: he knows that the classification which is being worked out is not an imaginary but a real one. The classification which unites animals into groups within groups, grounded on their likeness more or less to one another, indicates a real and natural relationship in those which are placed together.

Of course, the fact that we can say so many things which are true of a whole group of animals, but which cannot be said of any animal not belonging to that group, greatly simplifies the whole study of comparative anatomy. Thus we can frame definitions of groups, but there is this difficulty in this treatment of the subject: we are not acquainted with all animals, and it not unfrequently happens that when we have made our definitions of two groups, apparently perfectly distinct, some strange creature from some outlandish country is brought home which has some of the characters given in one definition and some that are given in the other. Then the definitions have to be re-framed so as to include the new species on one side or other of the line of demarcation, or a new group made for its accommodation. To avoid this result, it is perhaps better to take some one animal of a group which has all the essential features of its group well developed, and describe it as a type, laying stress on the description of those peculiarities which are the most widely possessed by the members of the group. As a matter of fact, it will be found that an immense number of forms cluster closely around such a typical species, whilst those forms which lie between two such types will be few and rare. This plan of describing types we shall endeavour to follow; but since the human mind longs for definitions because they are definite, we can hardly escape sometimes giving them.

The animal kingdom is the realm we have to explore. How is it bounded? The question involves us in the very difficulty to which we have just referred. The animal kingdom is cut off from the mineral kingdom by the fact that while a mineral remains unchanged unless acted on by external forces, an animal is compelled to pass through a series of changes. But how shall we distinguish an animal from a vegetable? The answer which would naturally suggest itself is: An animal moves and feels. Yes, but what is meant by movement and feeling? Many animals are fixed, and grow up from the rocks beneath the ocean as plants do, and some plants possess not only motion but locomotion. We cannot interrogate the lowest animals as to whether they feel, and if we are guided by appearances the sensitive mimosa feels. The fact is, we cannot define, for whatever the definition, some troublesome species of plant or animal obtrudes itself to disturb our distinction. We can, however, affirm many things about plants and animals which are generally true of the one kingdom and exclusive of the other. Thus, animals cannot exist on mineral substances alone, but most plants both can and do do so. Animals generally have an internal cavity to lodge their food while it is being dissolved and absorbed; plants have no stomach. Most animals have a nervous system, that is, a material by which the whole organism is connected into a sentient individual, and which conveys volition through the frame; no plant has a nervous system. These contrasts between a typical animal and a typical plant must satisfy the reader. The lower groups in both kingdoms present species which it may be difficult to assign to their respective spheres; but by keeping in mind the typical or ideal plant or animal, we shall usually be able to determine the position of every form which presents itself.

We shall now give an outline of the classification of the animal kingdom, only showing its main features, and not descending into the minor divisions, and then take a type of each class, and describe it so as to bring out its peculiar characteristics. The student will find it a great and material help, as he proceeds in his study of this subject, if he does not content himself merely with committing to memory the written description of various characteristics in the construction of animals, but refers to the particular animal selected as an illustration, and so fixes the truth in his mind by the aid of actual experience. With a view to enable the reader thus to verify the statements for himself, and to impress them intelligently on his memory, the types chosen will, so far as it is possible, be ordinary and familiar animals in each department.

It will prevent confusion in the mind of the reader not only of the following lessons, but of all books on this subject, if he have a clear idea of the terms applied to the different grades of the groups in classification. We give the principal names employed in the order of their importance, reading from left to right; and taking three familiar examples, we give the names of the groups into which they fall, proceeding from the higher to the lower grade.

SUB-KINGDOM OR BRANCH.	CLASS.	ORDER.	FAMILY.	GENUS.	SPECIES.	COMMON NAME.
Vertebrata	Mammalia	Ungulata	Equidæ	Equus	Caballus	Horse
Articulata	Crustacea	Thoracostraca	Carididæ	Crangon	Vulgaris	Shrimp
Mollusca	Gastropoda	Pulmonata	Helicidæ	Helix	Aspersa	Garden Snail

A species is the lowest grade with which we shall have anything to do, and may be defined to be that assemblage of animals which are alike in every essential feature of structure, and any two of which (male and female) are capable of reproducing their own kind in perpetuity.

When we wish to name a species, we use two names, that of the genus, followed by that of the species: thus science names the horse *Equus caballus.*

A genus is an assemblage of species; a family a number of genera, and so on. Professor Agassiz has endeavoured to define all the grades, but his definitions are too vague to be useful. We will not attempt to give definitions, because all are open to objections, as, indeed, is that which we have given to define a species. What is essential to the student is to know that they rank one above the other, and are not used indiscriminately. He will soon see how they are applied as he gets to know more of the animal kingdom.

To carry out the example given:—The genus *Equus* includes not only the horse, but the ass, zebra, etc.; the family *Equidæ* includes all animals which have a single toe to each foot; the order *Ungulata* includes not only the horse family, but also the rhinoceros family, the hog family, etc.; the class *Mammalia* includes not only the *Ungulata*, but the *Carnivora*, *Rodentia*, etc., *i.e.*, all beasts, and the sub-kingdom *Vertebrata* includes not only Mammals, but birds, reptiles, and fish.

Other intermediate grades are often used, but those we have given are the best established. With this explanation the way is cleared for our next lesson in general classification.

The main divisions of the animal kingdom, called sub-kingdoms or branches, were first established on anything approaching a scientific basis by the great Baron Cuvier. Previous classifiers had endeavoured to mark out these divisions by differences in some one organ or system of organs. The system which was generally made use of, as producing the most natural classification, was that of the organs of circulation of the blood, or the nutritive fluid which answered to the blood. The classification of animals according to the structure of their hearts, blood-vessels, etc., was perhaps as good as any founded on any one system of organs. At least, our great anatomist, Hunter, who had carefully examined all the systems of organs of animals in relation to their use in classifying, thought so. It is now, however, recognised that it will not do to rely on any one character in classification. If a classification be made in dependence on the modifications of but one organ, it is sure to be unnatural. If, on the contrary, it can be stated that any group of animals is distinguished from the rest by peculiarities in two or more systems of organs, that group is almost sure to be a natural one. Cuvier was more successful than his predecessors, not so much because he had any better key by which to interpret the animal kingdom, as because he relied on no key, but trusting to his wide knowledge of the structure of animals, and to his sagacious perception of what similitudes or differences were fundamental and what unimportant, he made a classification which recognised the plan of structure of each animal as a whole, that is, as made up of the sum of its organs. The difficulties attending such a method are far greater, the definitions of the branches thus formed are less simple and precise, than those of the former methods, but the results have the merit of being true to nature, and therefore stable.

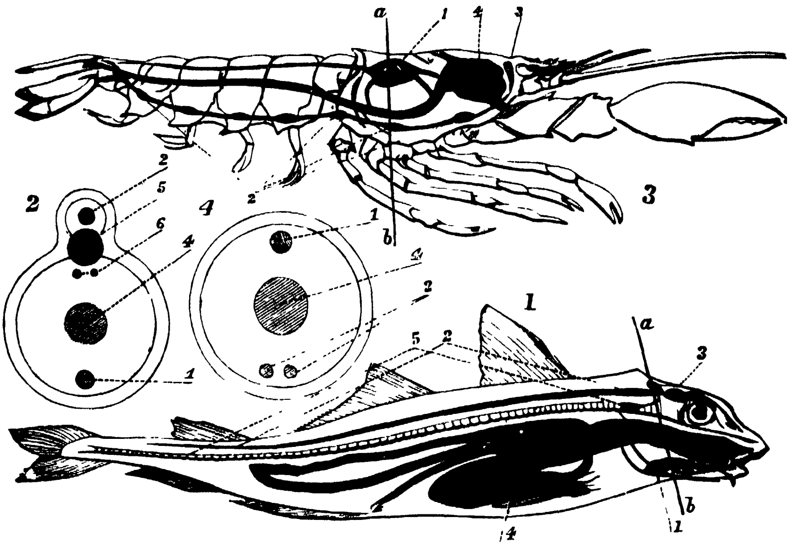

Fig. 1.—SKETCH OF HADDOCK, SHOWING ITS EXTERNAL FORM, AND ALSO THE ARRANGEMENT OF ITS INTERNAL ORGANS. Fig. 2.—TRANSVERSE SECTION OF HADDOCK AS EXHIBITED AT THE LINE *a b*. Fig. 3.—SKETCH OF LOBSTER, SHOWING ITS EXTERNAL FORM AND THE ARRANGEMENT OF ITS INTERNAL ORGANS. Fig. 4.—TRANSVERSE SECTION OF LOBSTER, EXHIBITED AT THE LINE *a b*. Refs. to Nos. in Figs. 1, 2, 3, 4.—1, heart; 2, nervous system; 3, brain; 4, alimentary canal; 5, vertebral column; 6, sympathetic nervous system.

Interesting as is the history of the various classifications of the animal kingdom from Cuvier through Owen, Huxley, and Gegenbaur to Claus, our space does not permit us to enlarge upon it; we must proceed to consider animals for ourselves.

Instead of at once enumerating the numbers of sub-kingdoms of the animal kingdom, and appending to each a dry catalogue of the characters upon which they are formed, it is, perhaps, better to induce the reader to examine two animals belonging to two different branches for himself, so that he may remark the essential differences in structure which they manifest. Suppose, then, he procure a prawn and a stickleback, or, if he aim at larger specimens, more easily examined, he can obtain, as we have done, a lobster and a haddock (Figs. 1–4). If these be carefully observed, first as to their external character, and then as to their internal organs, there will be found some points of similarity, but a great many points of difference.

Both are elongated animals, and both can be divided by a mid-vertical section into two similar halves. The outer covering of the fish, though it is covered with small scales, is thin and flexible. It offers but little resistance to pressure, and no firm support, or fixed point, from which muscles can play upon the limbs. It, moreover, evinces no manifest tendency to division into segments or rings. Turning to the lobster, we find it is enclosed in a hard inflexible armour, which is divided into segments or rings, placed one behind the other. This division is well marked and complete in the hinder part of the body, where there are seven hard annular pieces united by softer membrane. They overlap one another above, but are separated below. The great shield which covers the head and fore part of the body also consists of thirteen segments, but they have all become united. This thick hard outer covering is the only solid part of the animal, and therefore to this must be attached the muscles at both ends; that is, both at the fixed point of support from which they pull, and also at the part of the body or limbs which they are intended to move. This arrangement is carried out even to the limbs, whose joints are likewise cased in separate hard tubes, and which are wielded from within. Further, there is a manifest tendency for each segment of the body to have a pair of limbs. Indeed, on the last segment the limbs are not developed, but on the next they form the side lobes of the tail, and are the main instruments by which the lobster darts rapidly backwards when alarmed. The next four segments have each paired limbs, consisting of two small fringed plates set at the end of a joint, and with them the lobster paddles quietly forwards. Then comes a segment with a pair of limbs composed of two joints, used for other necessary purposes. Then under the great shield are the walking limbs, all many-jointed. Two pairs with one claw are preceded by two more terminated by small pincers; then come the formidable claws. Next come the foot-jaws and jaws. There are six pairs of these, placed closely one over the other, beneath the mouth; they cannot be seen in the engraving. Then come the two pairs of longer and shorter feelers. Thus each of the twenty segments of which the lobster's body consists has a pair of well-developed limbs, with the exception of the last.

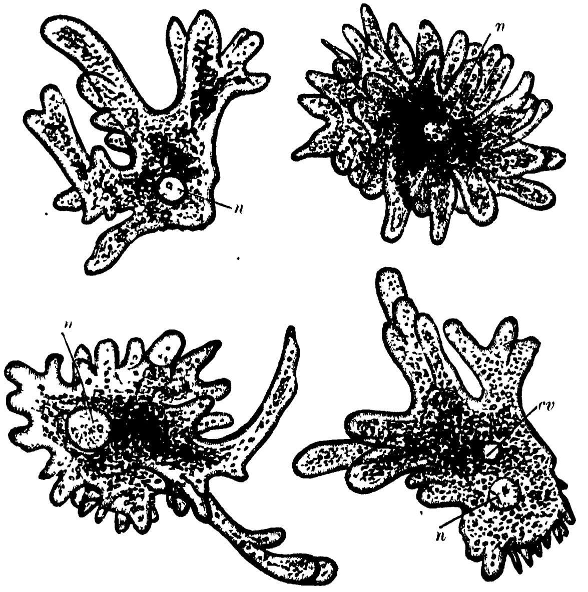

Fig. 5.—Amœba: *n*, nucleus; *cv*, contractile vacuole. (*After Jeffrey Bell.*)

How utterly different is the locomotive apparatus of the fish! The necessary hard parts upon which the muscles must play are nowhere to be found on the outside. They are situated internally. Running through the centre of the body from snout to tail is a bony column or axis. This axis consists of pieces which are so closely united end to end that they support one another, but they are capable of a slight motion on one another, so that the back-bone which they form can be bent and slightly twisted. This back-bone, ending forward in the base of the skull, is the main part of the hard skeleton which affords attachment to the muscles which move the limbs. In this case the tendency of each segment of the internal skeleton to produce limbs is so little marked, that there are not more than two pairs of paired limbs in all; and throughout this large sub-kingdom, which includes beasts, birds, reptiles, and fish, there are never more than this number found, though sometimes there is but one pair, and sometimes none at all. These limbs are not jointed hard tubes, pulled and moved by muscles running up the inside of them, but they are supported by bony levers, while the muscles act on them externally.

Passing on to the other systems of internal organs, we find a marked difference in the arrangement of the nervous, alimentary (food), and blood-circulatory systems, in relation to one another.

In the lobster the nervous system consists of a double series of rounded masses called ganglions, which commence with two lying side by side (though partially united together) above the mouth, and in connection with the eyes, antennæ (feelers), etc. From these two cords stretch back, one running on each side the mouth or throat, to another double ganglion, and, from this, cords pass back, which unite the remaining nervous masses together, all of which lie in a series along the floor of the tubular cavity of the body enclosed by the rings. Each ring has a double ganglion of its own, but these are sometimes united together, as in the lobster. The food canal runs from end to end through the centre of the body, and at its front extremity passes through the nervous tract (as we have seen), and opens on the under side of the body. The heart is situated above the food canal, and just under the hard covering of the back. We have, therefore, the main blood system situated above the food canal in the centre, and the nervous system below it; these two latter, however, crossing one another and exchanging places just at the front of the animal.

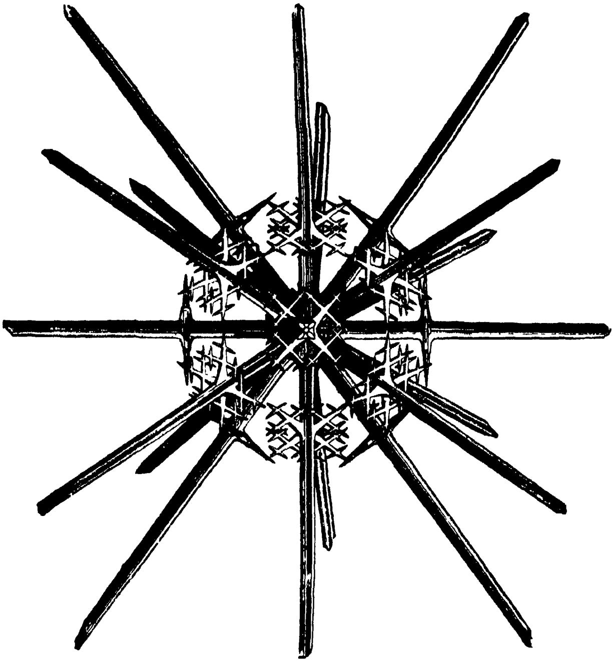

Fig. 6.—Xiphacantha, showing the Siliceous Skeleton. (*After Wyville Thomson.*)

Contrasted with this arrangement is that of the fish. In this animal the food canal occupies the same central position, but the heart, instead of lying above it, lies on the under side. The nervous system does not consist of a series of knots, but of a continuous column, contained in a special bony tube. The relative arrangement is best understood by a reference to the illustration, where transverse sections are given, supposed to be taken from the parts of the animals where the lines marked *a b* cross the lateral views of the lobster and haddock.

The fish and the lobster, then, present two types of structure which are utterly different in many fundamental points, and if in the comparison we have seized on those points which are of greatest importance, we shall find that when we compare any other animals belonging to these branches, first with the one type and then with the other, in reference to these peculiarities, we shall have no difficulty in classifying them either in one division or the other.

A dog, for instance, though a very different animal from a fish, is like it in the points we have noted. It has a back-bone of jointed vertebræ, and a columnar nervous system. It has no segmented external skeleton. It has but four limbs, and its jaws are not paired limbs lying side by side, but are placed one above the other. A dragon-fly is very different from a lobster in less fundamental particulars, but in the essentials named it is like to it. It has a chain of double nerve masses on the floor of its tubular body, crossed by the food canal between the first and second masses; and so we might run on through

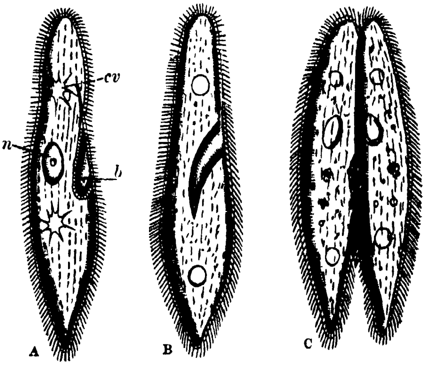

Fig. 7.—Paramœcium aurelia.
A, from the side: *n*, nucleus; *b*, mouth; *cv*, contractile vacuole. B, from below. C, two in conjugation.

the whole of the structure, and show that it was really built upon the same general plan as the lobster.

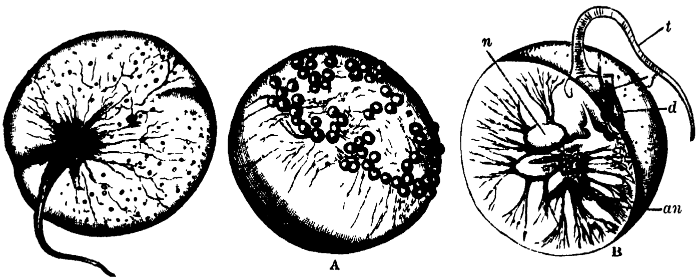

Fig. 8.—NOCTILUCA MILIARIS. A, with buds B, in section *an*, anus; *d*, denticle; *f*, flagellum; *t*, tentacle; *n*, nucleus.

The sub-kingdom to which the fish belongs is called *Vertebrata*, a vertebra being the technical name given to one of the joints of the back-bone. This name *vertebra* was given because the fact that the back-bone was so subdivided enabled its elements to turn one on another (*verto* being the Latin for *I turn*).

The lobster belongs to the invertebrate animals, but the invertebrates include more than one sub-kingdom, and that to which the lobster belongs was called by Cuvier *Articulata*, because they are jointed as to external skeleton of both body and limbs. *Articulus* is the Latin for *a joint*.

If, instead of a dog or dragon-fly, we had taken a slug, we should have found that while the arrangement of the nervous, blood, vascular, and food systems to one another was quite different from the fish, and similar to the lobster, yet we should have found no hard-jointed body, no chain of double ganglions on the floor of the body, and no limbs. This animal, therefore, belongs to neither of these types.

The student is now prepared for the enumeration of the great sub-kingdoms and their characters. They are these:—

Vertebrata.
Mollusca.
Molluscoida.
Arthropoda.
Echinodermata.
Vermes.
Cœlenterata.
Porifera.
Protozoa.

The names alone will be sufficient at present; any concise definition would convey no information worth having.

ELECTRICITY.—XII.

[*Continued from p* 126.]

PARAFFIN, GLASS, AND MICA CONDENSERS—METHODS OF TESTING CAPACITIES.

THE paraffin-wax condenser, whose construction has been described in the last lesson, is comparatively small and inexpensive, its capacity is large, constant, and does not vary much with variations in temperature, and for the purposes of ordinary commercial work it is a sufficiently trustworthy piece of apparatus. Where very high E.M.F.'s are used, as in connection with an induction-coil for increasing the length of the spark, the paraffin-wax condenser is useless; though its insulation resistance is very high, yet it cannot withstand the electric stress to which it is subjected, and the result will be that a spark will pass from one sheet of tinfoil to the other through the insulating paper. The perforation produced by the passage of this spark practically ruins the condenser by breaking down its insulation. The condenser suitable for such work should be made with either glass or ebonite as the dielectric, as either of these substances will withstand an enormous E.M.F. before a spark can pass through, and destroy their insulation. These condensers have very small capacities owing to the necessarily great thickness of glass or ebonite which separates the conducting sheets of tinfoil, but ability to resist rupture, rather than great capacity, is what is wanted for this class of work.

A paraffin-wax condenser, though good enough for ordinary work, is not considered good enough as a standard instrument. A condenser which is intended for use as a standard is made with sheets of mica as the insulating material, instead of paraffined paper, and the shape of the sheets is usually circular instead of rectangular. The insulation of such a condenser is far higher than that of the paraffin type, its ability to resist rupture by sparking is much greater, and though the tinfoil plates are separated to a greater distance than formerly, still this is counteracted by the high specific inductive capacity of the mica. The whole is held tightly together between two rigid plates, and the capacity of the condenser can be varied by varying the pressure on these plates. The adjustment of the capacity of such a condenser is clearly a simple operation, since it is only necessary to put on pressure and fix the positions of the plates

• when the capacity has attained the desired amount. The arrangement of the plates is shown in Fig. 64,

Fig. 64.—INTERNAL ARRANGEMENT OF A CONDENSER.

where B represents the terminal of one set of plates, and A the terminal of the other set. The black space between the plates is filled with the insulating mica.

In order to test the capacity of a condenser, or rather, to compare the capacities of two condensers, the following is the usual test:—The connections are arranged as shown in Fig. 65. E is a battery of suitable E.M.F., G is a ballistic galvanometer, K is a key, and F is the condenser.

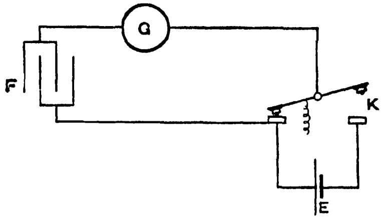

Fig. 65.—CONNECTIONS FOR CAPACITY TEST.

OBSERVATION (1) With these connections the key is depressed, and the throw on the galvanometer noted.

The condenser is now removed, and a standard one, of known capacity, is put in its place.

OBSERVATION (2) The key is again depressed, and the throw on the galvanometer again noted.

From these two observations we obtain the value of the condenser under test in terms of the standard, thus:—

$$\text{Unknown capacity} = \text{capacity of standard} \; \frac{\text{throw with unknown capacity}}{\text{throw with standard.}}$$

The truth of this can be seen from the following considerations:—The throw on the galvanometer is proportional to the quantity of electricity that passes through it, and is therefore proportional to the quantity that flows into the condenser when the key is depressed—or that flows out of the condenser when the key is released. Furthermore, the quantity that flows into the condenser depends upon two things: (1) the capacity of the condenser itself, and (2) the E.M.F. of the battery. As the same battery is used in observations (1) and (2), it is therefore clear that the capacities of the two condensers are proportional to the throws which they respectively give on the galvanometer.

Or, using symbols,

Let F_1 = capacity of standard condenser,
D_1 = throw obtained with standard condenser,
Q_1 = quantity of electricity in standard condenser,
F_2 = capacity of condenser under test,
D_2 = throw given by condenser under test,
Q_2 = quantity of electricity in condenser under test,
E = E.M.F. of battery.

In observation (1) $Q_2 = E F_2$.
In observation (2) $Q_1 = E F_1$.
Dividing one by the other we get

$$\frac{Q_1}{Q_2} = \frac{E F_1}{E F_2},$$

$$\text{or, } \frac{Q_1}{Q_2} = \frac{F_1}{F_2},$$

and since Q_1 and Q_2 are respectively proportional to D_1 and D_2, we may substitute in this expression, thus.—

$$\frac{D_1}{D_2} = \frac{F_1}{F_2},$$

$$\text{or, } F_2 = F_1 \frac{D_2}{D_1}.$$

Where the capacities of the condensers are very great, the throws may be so large as to be off the scale, and it may be necessary to put a shunt on the galvanometer in order to bring them down to readable values. A certain proportion of the charge will in this case pass through the shunt, but it must be remembered that the rules given in lesson VI. for the amounts of current that pass through the shunt and galvanometer **respectively, apply to *steady currents only***, and are not applicable in the cases of a sudden discharge, such as we must deal with in condenser work. The reason of this is that in the case of a rapidly varying current we must take into consideration the self-induction of the circuit, which it is not necessary to do when dealing with steady currents. If the same shunt is used in observations (1) and (2), the results obtained will be accurate, but if different shunts are used, accurate results cannot be obtained by simply multiplying the deflections by the "multiplying powers" of the shunt; some correction must be made for self-induction, but this is not often made, and in the majority of cases it is so small as to introduce but a very small error into the results. For rough testing we may neglect the small error introduced by using different shunts in (1) and (2) and use the formula

$$F_2 = F_1 \frac{D_2 \frac{G + S_2}{S_2}}{D_1 \frac{G + S_1}{S_1}}.$$

Where G = resistance of galvanometer,
S_1 = shunt used with throw D_1,
S_2 = shunt used with throw D_2.

In all kinds of condenser work the most scrupulous attention must be paid to the proper insulation of all the parts. If the condenser is in good order, the insulation resistance between one set of plates and the other is practically infinite, and if there is anything wrong with this insulation it is very quickly seen by the spot of light not returning to zero while the key is maintained depressed. Depressing the key charges the condenser and gives a throw on the galvanometer, but if the key is kept depressed the spot of light will vibrate, and finally settle down at zero if the insulation of the condenser is practically perfect; if instead of settling down at zero there is a permanent deflection, we know at once that the condenser is faulty, and that a permanent current is circulating through it. This fault is often due to surface-leakage on the outside of the case containing the condenser, between the terminals.

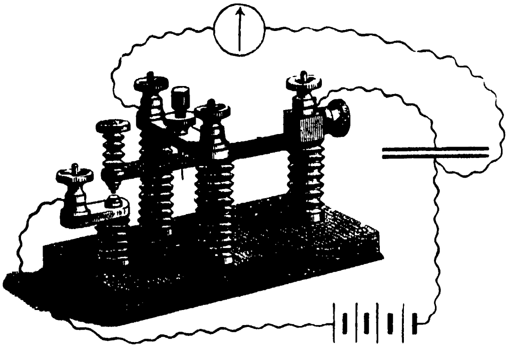

Fig. 66.—Key for Condenser Work.

The key used should be one in which the surface-leakage is reduced to the smallest possible quantity. The one shown in Fig. 66 is a good example of what such a key should be, and the wires are joined up to it in exactly the same manner as in Fig. 55. All the brass terminals are mounted on the tops of corrugated ebonite pillars, rising out of an ebonite or wooden base. The object of the corrugations is to increase the extent of surface over which leakage must take place.

A condenser, as we have seen, consists essentially of two large conducting surfaces, separated by a layer of insulation. A submarine cable clearly answers these requirements; the copper core is one conducting surface, the water is the other, and the gutta-percha is the insulation. The capacity of an ordinary submarine cable is roughly about $\frac{1}{3}$ microfarad per knot, and this fact furnishes us with a means of determining the position of a certain class of fault which occurs in these cables. It may happen that the copper wire will become broken and the ends separated, whilst the insulation surrounding the break remains perfect. In order to find the position of this fault, we have simply to test the capacity of the cable from one end; the capacity that we then determine is the capacity from that end up to the fault, and as we know the capacity of the cable per knot—from tests previously made, both during its manufacture and when in position—we know precisely where the fault has occurred.

One objection to the capacity test described lies in the fact that it is necessary to read the throws accurately; but with some practice it will be found that there is little difficulty in obtaining an accuracy of ·5 per cent. The really serious objection to the test comes into play when we are dealing with a capacity which differs very greatly from that of the standard. Unless we use different shunts we cannot obtain large throws from both the large and the small capacity. The test to apply in such a case is due to Sir W. Thomson, and the connections for it are shown in Fig. 67.

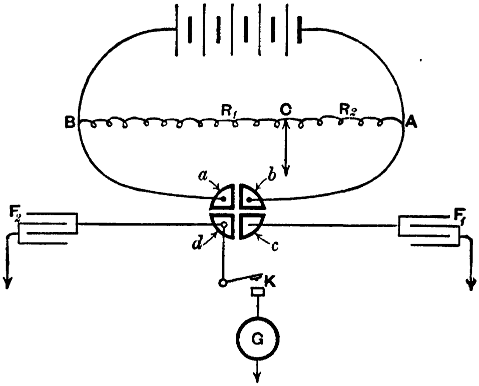

Fig. 67.

The battery is sending a current permanently through the resistance $R_1 R_2$, the ends of which are connected, as shown, to the pieces *a* and *b* of the plug key; F_1 is the standard condenser; F_2 is the capacity that we want to determine; K is a press key, and G a galvanometer; C is a contact piece which can make contact at any point along the resistance $R_1 R_2$. The arrow-heads show that all those points are connected to earth.

Operation (1).—Insert a plug between *a* and *d*, and one between *b* and *c*. This will charge both condensers, but with different E.M.F.'s depending upon the position of the contact-maker C. The condenser F_1 will be charged by the E.M.F. working between A and C, and the condenser F_2 will be charged by the E.M.F. working between the points B and C. It is therefore clear that we can control the quantity of electricity that flows into either condenser, and that by adjusting the position of C we can make equal quantities flow into both. The one difficulty is to know when these quantities are equal, and the galvanometer is provided for that purpose.

OPERATION (2).—Withdraw the plugs from between *a* and *d* and from between *b* and *c*, and insert one between *c* and *d*. This has the effect of making the charges in the condensers unite; and as one of these charges is positive and the other negative, the resultant charge will be the difference between the two charges. If the charges were equal in the first instance, there would be no charge remaining.

OPERATION (3).—Keeping the plug between *c* and *d* still in position, depress the key K and see if any charge passes through the galvanometer. If there is any movement of the needle the charges in the two condensers were not equal, and the contact C must be again adjusted, and the three operations again gone through. This must be continued till we get no deflection, and we then know that the charges in the condensers were equal. When this state of things has been arrived at, the unknown capacity can be determined thus—

$$F_2 = F_1 \frac{R_2}{R_1}.$$

The truth of this can be seen when we consider the E.M.F. between A and C is proportional to R_2, and the E.M.F. between B and C is proportional to R_1, and that it is these E.M.F.'s that charge the condensers F_1 and F_2 respectively.

Calling them E_2 and E_1, we have

$$Q = E_2 F_1 = E_1 F_2,$$

since the quantity in each condenser is equal; but

$$\frac{F_1}{F_2} = \frac{R_1}{R_2},$$

$$\therefore \quad R_2 F_1 = R_1 F_2,$$

$$\therefore \quad F_2 = F_1 \frac{R_2}{R_1}.$$

This is a most trustworthy method of testing any capacity, and though it is not a rapid method it is one to be recommended for accurate results.

LATIN.—XXXIII.

[*Continued from p.* 129.]

THE AGRICOLA OF TACITUS (*continued*).

Insurrection of the Britons crushed by Paulinus. Other Governors of Britain.

16. His atque talibus invicem instincti, Boudicea generis regii femina duce (neque enim sexum in imperiis discernunt) sumpsere universi bellum; ac sparsos per castella milites consectati, expugnatis praesidiis ipsam coloniam invasere ut sedem servitutis, nec ullum in barbaris saevitiae genus omisit ira et victoria. Quod nisi Paulinus cognito provinciae motu propere subvenisset, amissa Britannia foret; quam unius proelii fortuna veteri patientiae restituit, tenentibus arma plerisque, quos conscientia defectionis et propius ex legato timor agitabat, ne quamquam egregius cetera adroganter in deditos et ut suae cujusque injuriae ultor durius consuleret. Missus igitur Petronius Turpilianus tamquam exorabilior et delictis hostium novus eoque poenitentiae mitior, compositis prioribus nihil ultra ausus Trebellio Maximo provinciam tradidit. Trebellius segnior et nullis castrorum experimentis, comitate quadam curandi provinciam tenuit. Didicere jam barbari quoque ignoscere vitiis blandientibus, et interventus civilium armorum praebuit justam segnitiae excusationem: sed discordia laboratum, cum adsuetus expeditionibus miles otio lasciviret. Trebellius, fuga ac latebris vitata exercitus ira indecorus atque humilis, precario mox praefuit, ac velut pacti, exercitus licentiam, dux salutem essent, seditio sine sanguine stetit. Nec Vettius Bolanus, manentibus adhuc civilibus bellis, agitavit Britanniam disciplina: eadem inertia erga hostis, similis petulantia castrorum, nisi quod innocens Bolanus et nullis delictis invisus caritatem paraverat loco auctoritatis.

Vigorous Policy of Petilius Cerialis and Julius Frontinus.

17. Sed ubi cum cetero orbe Vespasianus et Britanniam recuperavit, magni duces, egregii exercitus, minuta hostium spes. Et terrorem statim intulit Petilius Cerialis, Brigantium civitatem, quae numerosissima provinciae totius perhibetur, adgressus. Multa proelia, et aliquando non incruenta; magnamque Brigantium partem aut victoria amplexus est aut bello. Et Cerialis quidem alterius successoris curam famamque obruisset: sed sustinuit molem Julius Frontinus, vir magnus, quantum licebat, validamque et pugnacem Silurum gentem armis subegit, super virtutem hostium locorum quoque difficultates eluctatus.

First Campaign of Agricola in Britain, A.D. 78. *His Modesty about his Successes.*

18. Hunc Britanniae statum, has bellorum vices media jam aestate transgressus Agricola invenit, cum et milites velut omissa expeditione ad securitatem et hostes ad occasionem verterentur. Ordovicum civitas haud multo ante adventum ejus alam in finibus suis agentem prope universam obtriverat, eoque initio erecta provincia. Et quibus bellum volentibus erat, probare exemplum ac recentis

legati animum opperiri, cum Agricola, quamquam transvecta aestas, sparsi per provinciam numeri, praesumpta apud militem illius anni quies, tarda et contraria bellum inchoaturo, et plerisque custodiri suspecta potius videbatur, ire obviam discrimini statuit; contractisque legionum vexillis et modica auxiliorum manu, quia in aequum degredi Ordovicesi non audebant, ipse ante agmen, quo ceteris par animus simili periculo esset, erexit aciem. Caesaque prope universa gente, non ignarus instandum famae ac, prout prima cessissent, terrorem ceteris fore, Monam insulam, a cujus possessione revocatum Paulinum rebellione totius Britanniae supra memoravi, redigere in potestatem animo intendit. Sed ut in subitis consiliis naves deerant: ratio et constantia ducis transvexit. Depositis omnibus sarcinis lectissimos auxiliarium, quibus nota vada et patrius nandi usus, quo simul seque et arma et equos regunt, ita repente inmisit, ut obstupefacti hostes, qui classem, qui naves, qui mare expectabant, nihil arduum aut invictum crediderint sic ad bellum venientibus. Ita petita pace ac dedita insula clarus ac magnus haberi Agricola, quippe cui ingredienti provinciam, quod tempus alii per ostentationem et officiorum ambitum transigunt, labor et periculum placuisset. Nec Agricola prosperitate rerum in vanitatem usus, expeditionem aut victoriam vocabat victos continuisse; ne laureatis quidem gesta prosecutus est, sed ipsa dissimulatione famae famam auxit, aestimantibus quanta futuri spe tam magna tacuisset.

Moderation of His Government.

19. Ceterum animorum provinciae prudens, simulque doctus per aliena experimenta parum profici armis, si injuriae sequerentur, causas bellorum statuit excidere. A se suisque orsus primum domum suam coërcuit, quod plerisque haud minus arduum est quam provinciam regere. Nihil per libertos servosque publicae rei, non studiis privatis nec ex commendatione aut precibus centurionem militesve ascire, sed optimum quemque fidissimum putare. omnia scire, non omnia exsequi. Parvis peccatis veniam, magnis severitatem commodare; nec poena semper, sed saepius poenitentia contentus esse; officiis et administrationibus potius non peccaturos praeponere, quam damnare cum peccassent. Frumenti et tributorum exactionem aequalitate munerum mollire, circumcisis quae in quaestum reperta ipso tributo gravius tolerabantur. Namque per ludibrium adsidere clausis horreis et emere ultro frumenta ac ludere pretio cogebantur. Devortia itinerum et longinquitas regionum indicebatur, ut civitates proximis hibernis in remota et avia deferrent, donec quod omnibus in promptu erat paucis lucrosum fieret.

Active Measures in Britain.

20. Haec primo statim anno comprimendo egregiam famam paci circumdedit, quae vel incuria vel intolerantia priorum haud minus quam bellum timebatur. Sed ubi aestas advenit, contracto exercitu multus in agmine, laudare modestiam, disjectos coërcere; loca castris ipse capere, aestuaria ac silvas ipse praetentare; et nihil interim apud hostes quietum pati, quominus subitis excursibus popularetur; atque ubi satis terruerat, parcendo rursus invitamenta pacis ostentare. Quibus rebus multae civitates, quae in illum diem ex aequo egerant, datis obsidibus iram posuere, et praesidiis castellisque circumdatae, tanta ratione curaque, ut nulla ante Britanniae nova pars.

Civilisation of the People.

21. Illacessita transiit sequens hiems, saluberrimis consiliis absumpta. Namque ut homines dispersi ac rudes eoque in bella faciles quieti et otio per voluptates adsuescerent, hortari privatim, adjuvare publice, ut templa, fora, domos extruerent, laudando promptos et castigando segnes. Ita honoris aemulatio pro necessitate erat. Jam vero principum filios liberalibus artibus erudire, et ingenia Britannorum studiis Gallorum anteferre, ut qui modo linguam Romanam abnuebant, eloquentiam concupiscerent. Inde etiam habitus nostri honor et frequens toga. Paulatimque descensum ad delenimenta vitiorum, porticus et balnea et conviviorum elegantiam. Idque apud imperitos humanitas vocabatur, cum pars servitutis esset.

NOTES TO TACITUS.

Chap. XVI.—*In vicem instincti*, "arousing each other." *In vicem* (*i.e.*, *in* and the accusative *vicem*) is used as an adverb—"in turn," "mutually."

Neque enim . . . discernunt. This parenthesis explains *femina*. "Boadicea, although a woman, led the revolt."

Milites is accusative.

Ipsam coloniam. "They not only attacked the Roman garrisons scattered over the country, but even carried their arms into the Roman settlement."

Ira et victoria forms one idea, "rage combining with victory," and is the subject of *omisit*.

Quod with *si*, *nisi*, and some other conjunctions, is used in the sense of "but."

Veteri patientiae restituit. "He restored to its previous state of submission."

Tenentibus. This refers to the state of affairs even after the Britons were subdued.

Propius with *agitabat*. "Troubled more closely"—*i.e.*, "more particularly."

Ne . . . consuleret. This difficult sentence depends on *timor*, and gives the ground of their fear; *egregius cetera* is parenthetical. "Excellent as he was in all other respects."

Ut suae cujusque injuriae ultor. The order is, *Ultor cujusque injuriae ut suae.* "As if his own."

Tamquam exorabilior. "As being more open to appeals."

Delictis—dative with *novus.* "Fresh to," "a stranger to."

Poenitentiae (dative). "Milder to repentance"—*i.e.*, "to those who repented."

Nullis castrorum experimentis. A descriptive ablative, "With no experience of active service."

Ignoscere vitiis blandientibus. "To make allowance for attractive vices"—*i.e.*, they were content to remain peaceful, as long as the governor was slothful.

Civilium armorum. The disturbances which followed the death of Nero in A.D. 69.

Discordia laboratum. "Trouble was caused by mutiny" The governor of a province had not only to control the subject people, but to keep his own troops in order.

Indecorus atque humilis. "Disgraced and humiliated because he escaped the wrath of the soldiers by running away and hiding."

Precario. "On sufferance."

Velut pacti . . . essent. "As though they had bargained—the army for licence, the general for life."

Petulantia. "Insubordination."

Nisi quod introduces a qualification to the general sense; we should begin a new sentence, "Only Bolanus was upright."

Chap. XVII.—*Recuperavit.* "Restored to order."

Aliquando. "On some occasions."

Aut victoria amplexus aut bello—*i.e.*, "He either conquered, or at least attacked."

Alterius, "any other." A somewhat rare use of *alter* in the sense of *alius.*

Molem. "The burden (of the war)"; used in a metaphorical sense.

Quantum licebat with *vir magnus*—*i.e.*, "As far as anyone could rise to greatness under the Empire."

Super. "Besides."

Chap. XVIII.—*Vices bellorum.* "The fortune (*lit.* the turns) of war."

Aestate. 78 A.D.

Velut omissa expeditione. "As if the campaign were over (for that year)." Military operations were usually suspended in the winter.

Ad occasionem. "An opportunity (for attack)."

Alam . . . agentem. "A squadron of (allied) cavalry serving." *Ala* denotes the cavalry of the allies in opposition to *turma* (Roman cavalry).

Erecta. "Excited (to revolt)."

Quibus bellum volentibus erat. An imitation of a common Greek construction. Literally, "Those to whom war was wishing for it"—*i.e.*, "those who wished for war."

Probare . . . opperiri. Historical infinitives.

Cum . . . statuit. This clause, which is grammatically subordinate, contains the principal statement. *Quamquam videbatur* gives the reason why he was not expected to take active measures.

Numeri. "Divisions," "detachments."

Praesumpta, etc., a difficult sentence. "The fact that peace for that year had been taken for granted seemed likely to cause delay and difficulty to one about to begin war, and to most people it seemed better that suspected points should be watched." *Tarda* is used in an active sense = "delaying."

Vexillis. Detachments of troops serving under a standard (= *numeri* above).

Ante agmen. "In front of the ranks."

Erexit aciem. "Led his force up hill."

Instandum, sc. *esse*, and *fore* are governed by *ignarus.*

Supra memoravi. (*See* Chapters XIV. and XV.)

Transvexit. "Managed the crossing." Singular verb with two subjects in the singular—*ratio et constantia.*

Quibus nota vada. "Who were experienced in fords"—*i.e.*, some of Agricola's auxiliaries, probably the Batavians, were used to fording shallows, and were good swimmers (*patrius nandi usus*).

Qui . . . expectabant. "They expected that if the Romans did attack, they would come by sea, in ships."

Quod tempus—*i.e.*, time of first entering a province.

Officiorum ambitum. "A round of duties."

Expeditionem . . . continuisse. "Applied the title of campaign or victory to the task of keeping subjects in check."

Laureatis, sc. *litteris.* It was the custom for a general who had won a victory to send home a despatch wreathed with laurel.

Aestimantibus. May be dative, "to people who," etc., or ablative absolute with subject omitted.

Quanta futuri spe. The emphasis of the clause is on this ablative absolute: "How great his hopes of the future (*must be when*) he said nothing of such great achievements."

Chap. XIX.—*Animorum*, "temper"; as often in the plural.

Aliena experimenta. "Experience of others."

Injuriae. "Wrong-doing," "oppression."

Domum suam coercuit. "Kept his own household under restraint."

Nihil . . . publicae rei, sc. *agere.*

Ascire. "To choose (for service)."

Non peccaturos. "Men not likely to transgress."

Frumenti et tributorum. Tribute was paid either in money or corn; and the levying of the latter kind of tribute gave rise to great grievances, as Tacitus proceeds to explain. Agricola remedied the hardship by "an equalisation of burdens."

Namque per ludibrium, etc. The sense seems to be that certain Britons, who did not grow corn, had to buy corn for tribute from the Roman granaries. This was a mere farce (*per ludibrium*), and therefore they are said, *ludere pretio*, "to play with the price"—*i.e.*, "to play at buying."

Devortia itinerum, "byways." Distant places were fixed upon by the governors, so that the unfortunate Britons might pay money to be relieved of the journey.

Proximis hibernis (ablative absolute). "With winter quarters near them."

Quod . . . erat—*i.e.*, "The furnishing of corn."

Chap. XX.—*Famam paci circumdedit.* This is a curious image: "clothed peace with glory," *i.e.*, "gave back to her her good report."

Intolerantia. "Severity."

Multus in agmine. Multus is here used almost like an adverb; "often with his troops on the march." *Agmen* means an army on the march, as *acies* means an army in battle array.

Laudare, etc. The infinitives in this passage are historic infinitives.

Prætentare. "To try beforehand," *i.e.*, "to explore."

Apud hostes quietum pati, quominus, etc. Note this construction and translate: "He permitted the enemy no peace, without," etc.

Ex aequo agere. "To be independent."

Nova pars. The last sentence in the chapter is not very clear. *Nova pars* means a "freshly conquered part," and after these words you must supply, in order to complete the sense, *præsidiis castellisque circumdata.*

Chap. XXI.—*Illacessita, i.e.,* untroubled by war or rebellion.

Dispersi. "Scattered," *i.e.,* "not living in populous centres."

Rudes. "Uncivilised."

Publice. "Out of the public funds."

Ita honoris aemulatio. This is one of the compressed sentences of Tacitus which are so difficult to render literally into English. "So an honourable rivalry was substituted for compulsion." *Honoris* has almost the same meaning as *honesta.*

Anteferre has not here its general meaning "to prefer," but "to advance beyond." "He advanced the natural powers of the Britons beyond the industry of the Gauls." Thus the Britons strove to acquire the learning, and to imitate the manners of the Romans; even the toga became fashionable, and luxuries, which an uncivilised people knew not how to employ, added another link to the chain of slavery. This is a rough paraphrase of the latter half of the chapter; and as there are no verbal obscurities, you should have no difficulty in construing the passage with the help of the paraphrase.

KEY TO TACITUS (*continued*).

11. For the rest; who were the first inhabitants of Britain, whether natives or foreigners, little is known, as you would expect among savages. The physical types vary; whence arguments are drawn. For the red hair of the Caledonians and their large limbs testify German origin. The dark complexion of the Silures, their hair, which is generally curled, and the fact that Spain is opposite to them, furnish ground to believe that the ancient Iberians had arrived thence here, and taken possession of the territory. They who live next to the Gauls, are also like the Gauls; whether it be that the spirit of the original stock still remains, or whether in countries near adjoining, the climate gives the same form to the bodies of men. Taking a broad view, I find it credible that the Gauls at first occupied the island, which is their neighbour. That their sacred rites are the same, you may learn from their being possessed with the same superstition of every sort. Their speech does not much vary. In daring and dangers they are prompted by the like boldness, and with the like affright avoid them when they approach. In the Britons, however, superior ferocity and defiance is found, as in a people not yet softened by a long peace. For we learn from history that the Gauls too once flourished in war: amongst them afterwards, together with peace and idleness, there entered effeminacy; and thus they lost their spirit and liberty. The same happened to those of the Britons who were conquered long ago. The rest still continue such as the Gauls once were.

12. Their principal force consists in their infantry. Some tribes amongst them make also war in chariots. The charioteer is the man of noble birth, while the dependents fight. They were formerly subject to kings. Now they are divided through the action of chieftains by faction and intrigue. Nor against nations thus powerful does aught so much avail us, as that they consult not for the common good. Two or three states seldom combine together to ward off a common danger. So that whilst only a single community fights at a time, the whole are vanquished. The sky from frequent clouds and rain is dull and hazy. Excessive cold they feel not. Their days in length surpass ours. Their nights are very clear, and at the extremity of the country, very short; so that between the setting of the sun and the dawn you perceive but small interval. They affirm that were it not for the intervention of clouds, the rays of the sun would be seen in the night, and that it does not rise and fall, but only passes by. For that the extremities of the earth, which are level, yielding but a low shadow, prevent darkness from rising high and spreading; and thence night is far short of reaching the stars and the sky. The soil is such, that except the olive and the vine, and other vegetables, which are wont to be raised in hotter climes, it readily bears all fruits and grain, and is very fertile. It quickly produces, but its productions ripen slowly; and of both these effects there is the same cause, the extreme humidity of the earth and of the sky. Britain yields gold and silver, with other metals, all which prove the prize and reward of the conquerors. The sea also breeds pearls, but of a dark and livid hue, a defect by some ascribed to the unskilfulness of such as gather them. For, in the Red Sea they are pulled from the rocks alive and vigorous. In Britain they are gathered just as the sea casts them up. I, myself, could more readily believe that Nature has failed to give the pearls perfection, than that we fail in avarice

13. The Britons themselves are a people who cheerfully comply with the levies of men, and with the imposition of taxes, and with all the services enjoined by the Empire; provided they endure no illegal oppression. This they bear with impatience, for they have been subdued to obedience, not to slavery. To continue, the divine Julius, the first of all the Romans who entered Britain with an army, though by gaining a battle he frightened the natives, and became master of the coast,* must be acknowledged to have pointed out the way to posterity, rather than to have handed over the country already conquered. Then came the civil wars, and against the Commonwealth were turned the arms of her own leaders. Thus Britain was long neglected, and continued to be so even during peace. This was what Augustus called a policy, but what Tiberius styled an inherited rule. That Caius Cæsar meditated an invasion of Britain is well known; and he would have carried it out, had he not been quick to repent on account of his changeable disposition; besides that all his mighty efforts against Germany had failed. The divine Claudius accomplished the undertaking; having thither transported the legions, with a number of auxiliary forces, and having chosen Vespasian to take part in the design, whose approaching fortune was thus begun. Tribes were subdued, kings taken captive, and Vespasian pointed out to fate.

14. The first Governor of consular rank was Aulus Plautius, then Ostorius Scapula, both distinguished soldiers; and by degrees the nearest part of Britain was reduced into the condition of a province, and a colony of veterans was settled. To King Cogidunus certain states were given, a prince who even till our times continued in perfect fidelity to us. Thus was kept up a custom of the Roman people long since received, by which it employs even kings as the instruments of rule. Afterwards Didius Gallus confirmed the acquisitions of his predecessors; and further in the island he raised a few forts, purely for the credit of having enlarged his government. Next to Didius came Veranius, and died in less than a year. Then immediately succeeded Suetonius Paulinus, who during two years commanded with success, subdued fresh nations, and established garrisons. On the strength of which he went to assail the Isle of Anglesey, as a place which supplied the rebel with succours, and thus left the country behind him exposed to the enemy.

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* Cæsar conquered to the north of the Thames.

15. The Britons, when through the absence of the legate they were eased of their fear, began to commune together concerning the miseries of bondage, to recount their several grievances, and so by discussing to heighten their injuries. "Their patience," they said, "availed them nothing further than to invite the imposition of heavier burdens upon a people who thus tamely submit. In times past they had only a single king: they were now surrendered to two. The legate tyrannised over their lives, the procurator over their fortunes. Equally pernicious to their subjects was the discord and unanimity of their rulers. The staff of the one, the centurions, the slaves of the other, mixed violence with insult. To such height was oppression grown, that nothing whatever was exempt from their avarice, nothing whatever from their lust. In the day of battle it is always the stronger that spoils. But here it was chiefly by the cowardly and effeminate that their houses were seized, their children carried off, and their men obliged to enlist; as if their country were the only thing for which the Britons knew not how to die. In truth, what a small force would all the soldiers arrived in the island appear, would the Britons but compute their own numbers? It was from this consideration that Germany had thrown off the same yoke, though a country defended only by a river, not an ocean. To animate themselves to take arms, they had their country, their wives, their parents; whilst these their oppressors were prompted by nothing but their avarice and sensuality: nor would they fail to withdraw from the island, as even the divine Julius had withdrawn, if only we rivalled the bravery of our forefathers. Let us not give way to panic at the result of an encounter or two. Among the wretched, more ardour and firmness were ever found. Now even the gods show compassion on us, since they thus kept the Roman general at such a distance, and thus held the Roman army in another island. Nay, we have already gained the most difficult point: for we deliberate in such counsels that it is more dangerous to be caught than to dare.

GREEK.—X.

[*Continued from p.* 143]

I. PERSONAL PRONOUNS (*continued*).

(2) *The Adjective Personal Pronouns or Possessive Pronouns.*

CERTAIN pronouns partake of the nature of an adjective as well as of a pronoun. For instance, *my*, in "my book," qualifies the noun *book*, and might, without serious error, be denominated an adjective; but since *my* also represents a noun—a noun of the first person—or the pronoun *I*, which holds its place, *my* may also be termed a pronoun. *My*, consequently, is both an adjective and a pronoun, or an adjective pronoun. Inasmuch, too, as *my*, *thy*, *his*, etc., signify possession, they may be also designated possessive pronouns. The possessive pronouns are :—

Ἐμός, -ή, -όν, my.	**ἡμέτερος, -α, -ον,** our.
σός, -ή, -όν, thy.	**ὑμέτερος, -α, -ον,** your.
σφέτερος, -α, -ον, theirs.	

Instead of ἐμός, the Attics employed the genitive ἐμαυτοῦ, -ῆς, -οῦ in a reflexive meaning, and αὐτοῦ, -ῆς, -οῦ, in the signification of the personal pronoun of the third person. For example, **τύπτει τὸν ἑαυτο υἱόν**, ***he strikes the son of himself;*** that is, ***he strikes his son*** or ***his own son.*** You may also say, **τύπτει τὸν υ.ὸν τὸν ἑαυτοῦ.**

The possessive pronoun is used in Greek only for the sake of emphasis. When no contrast or other emphasis is intended, the pronoun is omitted, and its place is supplied by the article, as:—**Ἡ μήτηρ στέργει τὴν θυγατέρα**, literally, *the* mother loves *the* daughter; that is, *the mother loves her daughter*. The person of the verb and the context show what pronoun you should supply in English. Instead of the adjective personal pronoun *ἐμός*, *σός*, etc., the Greeks use with the same meaning the genitive of the substantive personal pronoun, as *ἐμοῦ*, *σοῦ*, also *ἐμαυτοῦ*, etc,

EXERCISE 61.

Translate into English :—

1. Ὁ ἐμὸς πατὴρ ἀγαθός ἐστιν· *or* ὁ πατὴρ μοῦ ἀγαθός ἐστιν· *or* ἀγαθός ἐστι μοῦ ὁ πατήρ. 2. Πάντες στέργουσι τοὺς σφετέρους πατέρας· *or* τοὺς ἑαυτῶν πατέρας· *or* τοὺς πατέρας τοὺς ἑαυτῶν. 3. Οἱ ὑμέτεροι παῖδες σπουδαίως τὰ γράμματα μανθάνουσιν. 4. Οἱ παῖδες ὑμῶν καλοί εἰσιν. 5. Ὑμῶν οἱ παῖδες σπουδαῖοί εἰσιν. 6. Τὰ ἡμῶν αὐτῶν τέκνα· *or* τὰ τέκνα τὰ ἡμῶν αὐτῶν ψέγομεν. 7. Ὁ φίλος σοῦ πιστός ἐστιν. 8. Ὁ φίλος μοῦ ἄπιστός ἐστιν. 9. Ὁ σὸς νοῦς τὸ σὸν σῶμα ἄρχει. 10. Ὁ μὲν ἐμὸς παῖς σπουδαῖός ἐστιν, ὁ δὲ σὸς οὔ.

EXERCISE 62.

Translate into Greek :—

1. Thy father is good. 2. My father is good. 3. Our father is good. 4. Their slaves are bad. 5. Our children learn diligently, but your children are foolish. 6. Thy friend admires his own deeds, but not those of others.

II. DEMONSTRATIVE PRONOUNS

are so called because they demonstrate (Latin *de*, and *monstro*, I show) or point out persons and things, showing what particular person or thing is in any case intended. They are, ὅδε, *this one* (pointing), and οὗτος, *this;* ἐκεῖνος, *that*.

	Singular.			*Plural.*		
	M.	F.	N.	M.	F.	N.
Nom.	οὗτος	αὕτη	τοῦτο.	οὗτοι	αὗται	ταῦτα.
Gen.	τούτου	ταύτης	τούτου.	τούτων	τούτων	τούτων.
Dat.	τούτῳ	ταύτῃ	τούτῳ.	τούτοις	ταύταις	τούτοις.
Acc.	τοῦτον	ταύτην	τοῦτο.	τούτους	ταύτας	ταῦτα.

Dual.

	M.	F.	N.
		ταύτα	τούτω.
G.D.	τούτοιν	ταύταιν	τούτοιν.

The pronoun ὅδε, ἥδε, τόδε is made up of the article ὁ, ἡ, τό, and the particle δε, and is so declined.

Ἐκεῖνος, ἐκείνη, ἐκεῖνο is declined like **αὐτός** *supra* (*i.e.*, quite regular except in the nominative and accusative neuter).

Like **οὗτος** decline **τοσοῦτος, τοσαύτη, τοσοῦτο,** *so great;* **τοιοῦτος, τοιαύτη, τοιοῦτο,** *such;* **τηλικοῦτος, τηλικαύτη, τηλικοῦτο,** *so old.* Remark, however, that the neuter singular, besides the form in **-ο**, has a form in **-ον**.

The pronoun **αὐτός, -ή, -ό** in the oblique cases performs the office of the personal pronoun (third person) singular and plural, as *him, her, it, them.* In union with the article—thus forming **ὁ αὐτός, ἡ αὐτή, τὸ αὐτό**—it signifies "*the same*" (in Latin *idem, eădem, ĭdem*). The article by crasis mingles with the pronoun in all cases in which the article ends in a vowel, making one word: thus, **ὁ αὐτός = αὑτός**, and in the feminine and neuter **αὑτή, ταὐτό**, commonly **ταὐτόν**; but as the crasis does not extend throughout, we give the pronoun in full:—

ὁ αὐτός contracted into **αὑτός.**

	Singular.			*Plural.*
N.	**αὑτός**	**αὑτή**	**ταὐτόν.**	**αὑτοί, αὑταί, ταὐτά.**
G.	**ταὐτοῦ**	**τῆς αὐτῆς**	**ταὐτοῦ.**	**τῶν αὐτῶν**, etc.
D.	**ταὐτῷ**	**ταὐτῇ**	**ταὐτῷ.**	**τοῖς αὐτοῖς**, etc.
A.	**τὸν αὐτόν**	**τὴν αὐτήν**	**ταὐτόν.**	**τοὺς αὐτούς**, etc.

The difference of accent and breathing thus distinguishes **ταὐτῇ**, *to the same* (woman), from **ταύτῃ**, *to this* (woman); and **ταὐτά**, *the same things*, from **ταῦτα**, *these things.*

III. THE RELATIVE PRONOUN ὅς, ἥ, ὅ, *who.*

	Singular.			*Plural.*			*Dual.*		
Nom.	**ὅς**	**ἥ**	**ὅ.**	**οἵ**	**αἵ**	**ἅ.**	**ὥ**	**ἅ**	**ὥ.**
Gen.	**οὗ**	**ἧς**	**οὗ.**	**ὧν**	**ὧν**	**ὧν.**	**οἷν**	**αἷν**	**οἷν.**
Dat.	**ᾧ**	**ᾗ**	**ᾧ.**	**οἷς**	**αἷς**	**οἷς.**	**οἷν**	**αἷν**	**οἷν.**
Acc.	**ὅν**	**ἥν**	**ὅ.**	**οὕς**	**ἅς**	**ἅ.**	**ὥ**	**ἅ**	**ὥ.**

IV. INDEFINITE AND INTERROGATIVE PRONOUNS.

Declension of **τις**, *someone;* and **τίς**, *who?*

Indefinite **τις**, *someone.* Interrogative **τίς**, *who?*

Singular.

	M. *and* F.	N.	M. *and* F.	N.
N.	**τις.**	**τι**, somewhat.	**τίς**, who, which?	**τί**, what?
G.	**τινός** *or* **του.**		**τίνος** *or* **τοῦ.**	
D.	**τινί** *or* **τῳ.**		**τίνι** *or* **τῷ.**	
A.	**τινά.**	**τι.**	**τίνα.**	**τί.**

Plural.

	M. *and* F.	N.	M. *and* F.	N.
N.	**τινές.**	**τινα** *or* **ἄττα.**	**τίνες.**	**τίνα.**
G.	**τινῶν.**		**τίνων.**	
D.	**τισί.**		**τίσι.**	
A.	**τινάς.**	**τινα** *or* **ἄττα.**	**τίνας.**	**τίνα.**

Dual.

	Indefinite	Interrogative
N.A.	**τινέ.**	**τίνε.**
G.D.	**τινοῖν.**	**τίνοιν.**

The indefinite **τις** is an *enclitic*—that is, it inclines or throws back its accent on the foregoing word. In general the indefinite pronouns are distinguished from the interrogative by being enclitics, and by their coming after, while the interrogative stand before, other words.

By uniting **ὅς** with **τις**, we obtain **ὅστις, ἥτις, ὅτι,** *who, whoever;* which is declined thus:—

Singular.

Nom. **ὅστις, ἥτις, ὅτι.**
Gen. **οὗτινος** *or* **ὅτου, ἧστινος.**
Dat. **ᾧτινι** *or* **ὅτῳ, ᾗτινι.**
Acc. **ὅντινα, ἥντινα, ὅτι.**

Plural.

Nom. **οἵτινες, αἵτινες, ἅτινα** *or* **ἅττα.**
Gen. **ὧντινων, ὅτων.**
Dat. **οἷστισι** (rarely **ὅτοις**), **αἷστισι.**
Acc. **οὕστινας, ἅστινας, ἅτινα** *or* **ἅττα.**

Dual.

N.A. **ὥτινε, ἅτινε.** G.D. **οἷντινοιν, αἷντιναιν.**

The interrogative pronouns—such as **ποῖος**, *of what kind?* **πόσος**, *how great?* **πότερος**, *which* (of two)?—in becoming indefinite and dependent take **ὁ** before them. Thus, **ὁποῖος**, *of whatever kind;* **ὁπόσος**, *of whatever magnitude;* **ὁπότερος**, *whichever.*

The negative compounds of **τις** (namely, **οὔτις, οὔτι, μήτις, μήτι,** *no one, nothing*) follow the simple **τις**. Thus, **οὔτις, οὔτινος, οὔτινι, οὔτινα, οὔτι, οὔτινες, οὔτινα**, etc.

VOCABULARY.

Ἕκαστος, -η, -ον, each, everyone.	**Οἷος, -α, -ον**, of what kind.
Ἡμέρα, -ας, ἡ, a day.	**Ῥόδον, -ου, τὸ**, a rose.
Ἔνιοι, -αι, -α, some.	**Στρατηγός, -οῦ, ὁ**, a general.
Ἐξετάζω, I inquire into, prove.	**Τρόπος, -ου, ὁ**, a manner, mode of life, character.
Ἐπιστολή, -ῆς, ἡ, a letter.	**Φροντίζω**, I take anxious care for; with acc., desire, pursue.
Μηδείς, μηδεμία, μηδέν, no one.	

EXERCISE 63.

Translate into English:—

1. **Ὁ ἀνὴρ οὗτος** (*or* **οὗτος ὁ ἀνήρ**) **ἀγαθός ἐστιν.** 2. **Ἡ γνώμη αὕτη** (*or* **αὕτη ἡ γνώμη**) **δικαία ἐστίν.** 3. **Ἡ γυνὴ ἥδε** (*or* **ἥδε ἡ γυνή**) **καλή ἐστιν.** 4. **Ὁ ἀνὴρ ἐκεῖνος** (*or* **ἐκεῖνος ὁ ἀνήρ**) **βασιλεύς ἐστιν.** 5. **Ὁ βασιλεὺς αὐτὸς** (*or* **αὐτὸς ὁ βασιλεὺς**) **στρατηγός ἐστιν.** 6. **Φέρε αὐτῷ, ὦ παῖ, τὴν κλεῖν.** 7. **Ἔνιοι περὶ τῶν αὐτῶν τῆς αὐτῆς ἡμέρας οὐ ταὐτὰ γιγνώσκουσιν.** 8. **Τὸ λέγειν καὶ τὸ πράττειν οὐ ταὐτόν ἐστιν.** 9. **Ταῦτα τὰ ῥόδα, ἃ θάλλει ἐν τῷ κήπῳ, καλά ἐστιν.** 10. **Σοφόν τι χρῆμα ὁ ἄνθρωπός ἐστιν.** 11. **Εἰ φιλίαν του** (*for* **τινός**) **διώκεις, τὸν τρόπον αὐτοῦ ἐξέταζε.** 12. **Τίς γράφει ταύτην τὴν ἐπιστολήν;** 13. **Λέγε μοι**

ὅστις ταύτην τὴν ἐπιστολὴν γράφει. 14. Ὧν (*by attraction for* ἃ) ἔχεις, τούτων ἄλλοις παρέχου. 15. Ὄλβιός ἐστιν ᾧ φίλοι εἰσίν. 16. Ἐκεῖνος ὀλβιώτατος, ὅτῳ (*for* ᾧτινι) μηδὲν κακόν ἐστιν. 17. Τί φροντίζεις; 18. Οὐ λέγω ὅτι φροντίζω. 19. Οἷον τὸ ἔθος ἑκάστου, τοιοῦτος ὁ βίος. 20. Τίς ἐστιν ἐκείνη ἡ γυνή; 21. Λέγε μοι, ἥτις ἐστὶν ἐκείνη ἡ γυνή.

There are some things in this exercise on which a few words seem desirable. First advert to an exemplification of an enclitic, as seen in the words σοφόν τι (10).

Τι is here an instance of an enclitic. First observe it comes after σοφόν, and then observe that it is so connected with it as that the two are pronounced together, almost or quite as if they were one word: thus, σοφοντι. In consequence of this, τι receives the name of *enclitic;* and for the same reason, losing its own accent, it throws it back on the preceding word: thus, σοφόν τι.*

You see in these exercises the usage of the article with demonstratives: *e.g.*, ὁ ἀνὴρ οὗτος, ἡ γυνὴ ἐκείνη, οὗτος ὁ παῖς, τοῦτο τὸ πρᾶγμα (*or* τὸ πρᾶγμα τοῦτο), that is, *the woman this*, or *this the woman*, for *this woman*. Sometimes, when emphasis is sought, we have the following order:—ὁ ἀνὴρ ὁ οὗτος, *the man, this one*.

The difference between the interrogative and indeterminate pronouns is exemplified in two or three examples in the last exercise: thus—

Interrogative.	τὶς γράφει ταύτην τὴν ἐπιστολήν;
Indefinite.	λέγε μοι ὅστις ταύτην τὴν ἐπιστολὴν γράφει.

The direct interrogative τίς passes in the second sentence into the indirect interrogative, or the dependent and indefinite ὅστις. Take another instance—

Direct Int.	τί φροντίζεις;	*What are you anxiously caring for?*
Indirect Int.	οὐ λέγω ὅτι φροντίζω.	*I tell* (*thee*) *not what I am caring for.*

CORRELATIVE PRONOUNS

are such as express a mutual relation one to another, as is exemplified in the words *how much? so much; this kind, that kind*, etc. They may be arranged under the heads of interrogative, indefinite, demonstrative, relative, and dependent pronouns. Thus, πόσος, *how much?* (Latin *quantus?*) asks a question which is answered by τόσος, *so much* (*tantus*). Ποσος may also signify *of some size* (*aliquantus*), and so become indefinite; and if we wish to say "I know not how much," we employ ὅσος or ὁποσος, and so call into use a relative and dependent form.

Interrog.	*Indefinite.*	*Demonst.*	*Rel. and Dep.*
πόσος, -η, -ον; *how great? how much?*	ποσός, -ή, -όν, *of some size.*	[τόσος, *poetic.*] τοσόσδε or τοσοῦτος, *so great.*	ὅσος, -η, -ον, ὁπόσος, -η, -ον, *how great.*
ποῖος, -α, -ον; *of what kind?* (qualis?)	ποιός, -ά, -όν, *of some kind.*	[τοῖος, -α, -ον, *poetic.*] τοιόσδε or τοιοῦτος, *of that kind* (talis).	οἷος, -α, -ον, ὁποῖος, -α, -ον, *of what kind.*
πηλίκος, -η, -ον; *of what age?*	—	[τηλίκος, -η, -ον, *poetic.*] τηλικόσδε, τηλικοῦτος, *of that age.*	ἡλίκος, -η, -ον, ὁπηλίκος, *how old.*

The enclitic γε is appended to the personal pronouns of the first and the second person, so as to give force and prominence to the word, as ἔγωγε, ἐμοίγε, ἐμοῦγε, ἐμέγε, σύγε, etc. It is almost impossible to give an English equivalent for γε, for by this, as well as by other particles, the Greeks expressed shades of meaning to which we have no counterparts. Γε, however, may be approximatively rendered by *at least* or *but*, sometimes by *yes*, as in affirmative sentences.

The particles δή, δήποτε, and οὖν are added to the interrogative and indefinite pronouns, as well as to ὅσος, in order to generalise their application—that is, to make them apply to everything included in the idea they convey—having a force similar to our *ever*, *soever*, etc., as in *whatsoever*, *whosoever*, *how much soever*, etc. For example, ὅστις δή, ὅστις δήποτε, ὁστισοῦν ἡτισοῦν, ὁτιοῦν, *whoever*, *whosoever*, *whosoever it may be*, etc. (Latin *quicunque*); genitive ὁτουοῦν, ἡστινοσοῦν; dative, ὁτῳοῦν, etc.

Similarly, the enclitic περ is subjoined to relatives, in order to raise the relative import into a demonstrative, or to give emphasis: as, ὅσπερ, ἥπερ, ὅπερ, *who indeed*. So ὅσοσπερ, οἷοσπερ.

The inseparable ι *demonstrativum* (demonstrative *iota*) is affixed to demonstratives as well as to some adverbs to augment the demonstrative force, being equivalent to our vulgar *there*, as in, "Which man do you mean? this man?" "No, that *there* man." This use of ι resembles the Latin *ce*, as in hic*ce*, and the French *ci*, as in celui-*ci*. (*N.B.*—It always has the accent.)

Singular.

	M.	F.	N.
N.	οὑτοσί, *that* man.	αὑτηί, *that* woman.	τουτί, *that* thing.
G.	τουτουί.	ταυτησί.	
D.	τουτῳί.	ταυτῃί.	
		Plural.	
N.	οὑτοιί.	αὑταιί.	ταυτί.

So ὁδί, ἡδί, τοδί, from ὅδε; οὑτωσί, from οὕτως; ἐνθαδί, νυνί, δευρί.

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* For the influence of enclitics on the accentuation of the preceding word, reference should be made to the rules given in the book recommended above (p. 21, *note*).

THE NUMERALS.

The *numerals* express the relation of number. According to their import, they may be divided into five classes—(1) The *Cardinals;* (2) the *Ordinals;* (3) the *Multiplicatives;* (4) the *Proportionals;* and (5), the *Substantive Numerals.*

The foundation of the whole are the cardinals, or *the chief*, so called because they are the hinge (in Latin, *cardo*) on which the others turn. The cardinals answer to the question *How many?* as, *one, two, five*, etc. Of the cardinals, the four that come first, and the round numbers from 200 (διακόσιοι) up to 10,000 (μύριοι), as well as the compounds of μύριοι, have the inflections of adjectives; all the rest are indeclinable. The thousands are formed by the help of numeral adverbs: for example, τρις-χίλιοι, 3,000.

The ordinals denote the order in which the numbers follow, or the place in the series held by a particular number: as, *the fourth*, τέταρτος. They are all inflected like adjectives of three terminations.

The multiplicatives denote *how often* a quality is repeated, as *twofold, fourfold.* They are compounds of πλοῦς, and have three adjectival terminations, -οῦς, -ῆ, -οῦν: as, διπλοῦς. Then there are numeral adverbs in -άκις, which answer to the question *How often?* as, ἑκατοντάκις, *a hundred times.*

The proportionals are compounds of πλάσιος, -α, -ον, and denote so much the more than some other object: as, διπλάσιος, *twice as much.*

The substantive numerals express the abstract idea of number: as, ἡ δυάς (gen. -αδος), *duality.*

The alphabet furnishes signs for numbers, as well as supplies the elements of words. Hence, with the Greeks, the four-and-twenty letters of the alphabet are so many ciphers. In the series, however, three obsolete forms are introduced—namely, after ε the letter βαυ (*vau*) or *digamma*, Ϝ, or Στι (that is, ϛ) as the sign for 6; also κοππα (that is, ϙ) as the sign for 90; and Σαμπι, ϡ, as the sign for 900.

The first eight letters, from *alpha* to *theta*, *bau* or *sti* included, make the first series consisting of units; the ensuing eight, from *iota* to *pi*, including *koppa*, form the second series, or the succession of tens; and the remaining eight, from *rho* to *omĕga*, together with *sampi*, make up the hundreds. *Eleven* is ια′, or 10 and 1; *twelve* is ιβ′, 10 and 2, etc.

Up to 999, the letters, when used as figures, have an accent over them each: thus, α′. When more than one sign stand together, the mark is over the last: thus, ιγ′. With 1,000, the alphabet begins afresh. In order to indicate this, the mark is placed under the letter: thus, α′ = 1, but ͵α = 1000; ι′ = 10, but ͵ι = 10,000. Thus, 1891 in Greek numerals is written ͵αωϙα′.

Subjoined are lists of the cardinals, the ordinals, and the numeral adverbs, accompanied by our numbers and the corresponding Greek signs. The English words, *one, two, three*, etc., need scarcely be added; and, of course, *first, second, third, tenth*, etc., will readily be supplied by the student.

		Cardinals.	*Ordinals.*
1	α′	εἷς, μία, ἕν	πρῶτος,
2	β′	δύο, *or* δύω	δεύτερος.
3	γ′	τρεῖς, τρία	τρίτος.
4	δ′	τέτταρες, -α, *or* τεσσαρ-	τέταρτος.
5	ε′	πέντε	πέμπτος.
6	ϛ′	ἕξ	ἕκτος.
7	ζ′	ἑπτά	ἕβδομος.
8	η′	ὀκτώ	ὄγδοος.
9	θ′	ἐννέα	ἔνατος.
10	ι′	δέκα	δέκατος.
11	ια′	ἕνδεκα	ἑνδέκατος.
12	ιβ′	δώδεκα	δωδέκατος.
13	ιγ′	τρεῖς καὶ δέκα	τρίτος καὶ δέκατος.
14	ιδ′	τέτταρες καὶ δέκα, *or* τέσσ-	τέταρτος καὶ δέκατος.
15	ιε′	πεντεκαίδεκα	πέμπτος καὶ δέκατος.
16	ιϛ′	ἑκκαίδεκα	ἕκτος καὶ δέκατος.
17	ιζ′	ἑπτακαίδεκα	ἕβδομος καὶ δέκατος.
18	ιη′	ὀκτωκαίδεκα	ὄγδοος καὶ δέκατος.
19	ιθ′	ἐννεακαίδεκα	ἔνατος καὶ δέκατος.
20	κ′	εἴκοσι(ν)	εἰκοστός.
21	κα′	εἴκοσιν εἷς, μία, ἕν	εἰκοστὸς πρῶτος.
30	λ′	τριάκοντα	τριακοστός.
40	μ′	τετταράκοντα, *or* τεσσ-	τετταρακοστός.
50	ν′	πεντήκοντα	πεντηκοστός.
60	ξ′	ἑξήκοντα	ἑξηκοστός.
70	ο′	ἑβδομήκοντα	ἑβδομηκοστός.
80	π′	ὀγδοήκοντα	ὀγδοηκοστός.
90	ϙ′	ἐνενήκοντα	ἐνενηκοστός.
100	ρ′	ἑκατόν	ἑκατοστός.
200	σ′	διακόσιοι, -αι, -α	διακοσιοστός.
300	τ′	τριακόσιοι, -αι, -α	τριακοσιοστός.
400	υ′	τετρακόσιοι, -αι, -α	τετρακοσιοστός.
500	φ′	πεντακόσιοι, -αι, -α	πεντακοσιοστός.
600	χ′	ἑξακόσιοι, -αι, -α	ἑξακοσιοστός.
700	ψ′	ἑπτακόσιοι, -αι, -α	ἑπτακοσιοστός.
800	ω′	ὀκτακόσιοι, -αι, -α	ὀκτακοσιοστός.
900	ϡ′	ἐνακόσιοι, -αι, -α	ἐνακοσιοστός.
1,000	͵α	χίλιοι, -αι, -α	χιλιοστός.
2,000	͵β	δισχίλιοι, -αι, -α	δισχιλιοστός.
3,000	͵γ	τρισχίλιοι, -αι, -α	τρισχιλιοστός.
4,000	͵δ	τετρακισχίλιοι, -αι, -α	τετρακισχιλιοστός.
5,000	͵ε	πεντακισχίλιοι, -αι, -α	πεντακισχιλιοστός.
6,000	͵ϛ	ἑξακισχίλιοι, -αι, -α	ἑξακισχιλιοστός.
7,000	͵ζ	ἑπτακισχίλιοι, -αι, -α	ἑπτακισχιλιοστός.
8,000	͵η	ὀκτακισχίλιοι, -αι, -α	ὀκτακισχιλιοστός.
9,000	͵θ	ἐνακισχίλιοι, -αι, -α	ἐνακισχιλιοστός.
10,000	͵ι	μύριοι, -αι, -α	μυριοστός.
20,000	͵κ	δύο μυριάδες, etc	

In forming compound numbers, you may put the smaller first and the larger second, interposing *καὶ*, *and*: as, *πέντε καὶ εἴκοσιν*, *five and twenty*. Or you may reverse the order, in this case keeping or omitting the conjunction: as, *εἴκοσι καὶ πέντε*, *twenty and five*, 25; and *πέντε καὶ τετταράκοντα καὶ τριακόσιοι*, or *τριακόσιοι καὶ τετταράκοντα καὶ πέντε*, or *τριακόσιοι τετταράκοντα πέντε*, 345.

THE NUMERAL ADVERBS.

1	*ἅπαξ.*	18	*ὀκτωκαιδεκάκις.*
2	*δίς.*	19	*ἐννεακαιδεκάκις.*
3	*τρίς.*	20	*εἰκοσάκις.*
4	*τετράκις.*	30	*τριακοντάκις.*
5	*πεντάκις.*	40	*τετταρακοντάκις.*
6	*ἑξάκις.*	50	*πεντηκοντάκις.*
7	*ἑπτάκις.*	60	*ἑξηκοντάκις.*
8	*ὀκτάκις.*	70	*ἑβδομηκοντάκις.*
9	*ἐννεάκις, ἐνάκις.*	80	*ὀγδοηκοντάκις.*
10	*δεκάκις*	90	*ἐνενηκοντάκις.*
11	*ἐνδεκάκις.*	100	*ἑκατοντάκις.*
12	*δωδεκάκις.*	200	*διακοσιάκις.*
13	*τρισκαιδεκάκις*	300	*τριακοσιάκις.*
14	*τετταρεσκαιδεκάκις.*	1,000	*χιλιάκις.*
15	*πεντεκαιδεκάκις.*	2,000	*δισχιλιάκις.*
16	*ἑκκαιδεκάκις.*	10,000	*μυριάκις.*
17	*ἑπτακαιδεκάκις.*		

DECLENSION OF THE FOUR FIRST NUMERALS —namely, *εἷς*, *one*; *δύο*, *two*; *τρεῖς*, *three*; *τέτταρες*, *four*.

	M.	F.	N.	ALL GENDERS.
Nom.	*εἷς*	*μία*	*ἕν.*	*δύο.*
Gen.	*ἑνός*	*μιᾶς*	*ἑνός.*	*δυοῖν.*
Dat.	*ἑνί*	*μιᾷ*	*ἑνί.*	*δυοῖν.*
Acc.	*ἕνα*	*μίαν*	*ἕν.*	*δύο.*

	M. F.	N.	M. F.	N.
Nom.	*τρεῖς*	*τρία.*	*τέτταρες*	*τέτταρα.*
Gen.	*τριῶν.*		*τεττάρων.*	
Dat.	*τρισί.*		*τέτταρσι* (*Poet.* *τέτρασι*).	
Acc.	*τρεῖς*	*τρία.*	*τέτταρας*	*τέτταρα.*

Like *εἷς*, decline its compounds, *οὐδείς* and *μηδείς*, *no one*; thus, *οὐδείς*, *οὐδεμία*, *οὐδέν*; genitive *οὐδενός*, *οὐδεμιᾶς*, etc.; plural (rare), *οὐδένες*, *οὐδένων*, *οὐδέσι*, etc.

Δύο is often used as an indeclinable word for all cases. The numeral *ἄμφω*, *both*, has, like *δύο*, in the genitive and dative *-οῖν*: thus, *ἀμφοῖν*; the accusative is the same as the nominative. Like *δύο*, *ἄμφω* is sometimes used as an indeclinable.

KEY TO EXERCISES.

Ex. 53.—1. The deepest sleep is the sweetest. 2. Many flowers yield a very sweet scent. 3. Nothing is swifter than youth. 4. The incontinent serve a most vile servitude. 5. Friendship is the sweetest of all things. 6. Nothing is more disgraceful than to have one thing in the mind, and to say another thing. 7. Serpents are most odious to all other animals. 8. Nothing is more hostile to man than man. 9. Most swiftly does time change things.

Ex. 54.—1. *Οὐδὲν ἥδιόν ἐστιν ἢ βαθὺς ὕπνος.* 2. *Ἥδιστός ἐστιν ὕπνος.* 3. *Οὐδὲν αἴσχιόν ἐστι τῆς δουλείας.* 4. *Ὀξύτατόν ἐστι δουλεία.* 5. *Ἵπποι εἰσὶ τάχιστοι.* 6. *Οὐδὲν ἐχθιόν ἐστιν ἢ βουλὴ κακή.* 7. *Αἴσχιστόν ἐστιν ἄλλα μὲν ἐν τῷ νῷ ἔχειν, ἄλλα δὲ λέγειν.* 8. *Οἱ πονηροὶ ἄλλα μὲν ἐν τῷ νῷ ἔχουσι, ἄλλα δὲ λέγουσι.* 9. *Οὐδέν ἐστιν ἥδιον πιστοῦ φίλου.*

Ex. 55.—1. The longest life is not the best, but the most virtuous. 2 Moderation is the best in all things. 3. The judgments of the more aged are the better. 4. No counsellor is better than time. 5. Either utter things better than silence or keep silence. 6. That which is most secure is always the best. 7. You jeer, O excellent friend. 8. At times cowards are more fortunate than brave men. 9. There is no worse evil to man than grief. 10. Flattery is the worst of all the other evils. 11. A man soft in soul and open to bribery. 12. Prudence is the fairest virtue for women. 13. There is no nobler possession than a friend. 14. Slavery is most painful to a free man. 15. The way is very long. 16. The crocodile grows very big from being very little. 17. The earth is less than the sun. 18. Be content even with less. 19. Very few men are happy. 20. No law is stronger than necessity. 21. Small gains often produce greater damage. 22. No evil is greater than anarchy. 23. War brings very many evils. 24. A desire for more is natural to man. 25. A good woman brings to her house very many good things. 26. Bear the necessities of life as easily as possible. 27. To order is easier than to do. 28. The fruits of wisdom are very ripe. 29. The branches of the vine in my father's garden are riper than in my neighbour's garden. 30. Iberia rears very fat sheep.

Ex. 56.—1. *Οὐδὲν βέλτιον πρακτικοῦ βίου.* 2. *Ἡ δόξα τῶν παλαιῶν ἐστὶ κρατίστη.* 3. *Ὁ χρόνος ἐστὶ σύμβουλος ἄριστος.* 4. *Τὸ ἀληθέστατον ἐστι κράτιστόν.* 5. *Ἡ λύπη ἐστὶ κακὸν μέγιστον.* 6. *Οὐδέν ἐστι χεῖρον ἢ κολακεία.* 7. *Οἱ ἀκρατέστατοι ταῖς ἡδόναις δουλεύουσι.* 8 *Γυναιξί ἐστιν οὐδὲν κάλλιον τῆς σοφίας.* 9. *Τοῖς ἐλευθέροις οὐδέν ἐστι κάκιον τῆς ἀναρχίας.* 10. *Ὁ κροκόδειλος μήγιστός ἐστι.* 11 *Ὁ υἱὸς μείων τοῦ πατρός.* 12. *Τοῖς κακοῖς ἐστι πολλάκις πλείονα ἢ τοῖς ἀγαθοῖς.* 13. *Πόλεμος φέρει πολλὰ καὶ μέγιστα κακά.* 14. *Τὸ μὲν κελεύειν ἐστὶ ῥᾷον, τὸ δὲ πείθεσθαι εὐτυχέστερον.* 15. *Οἱ κάρποι πεπαίτατοί εἰσιν ἥδιστοι.* 16. *Τὰ πρόβατα τοῦ πατρὸς ἐμοῦ εἰσι πιότερα ἢ τὰ τοῦ πλησίον.*

Ex 57.—1. I write, but thou playest 2. I worship thee, O mighty Jove. 3. O son, hear me. 4. My father is very dear to me. 5. God ever sees thee. 6. If you injure me, you do not differ from my enemies. 7. I am stronger than you. 8. Gladly do I obey thee, O father. 9. We rejoice with you. 10. The lyre delights you. 11. God affords us many good things. 12. Your father loveth you. 13. Fight manfully, O soldiers, for it is your duty to guard the city; for if you fly, all the city is destroyed. 14. It is your duty, O boys, to learn your letters earnestly. 15. The mother loves us. 16. Ours was an evil disease. 17. You have a most trusty friend. 18. The father gratifies you, for you learn your letters well. 19. O master, listen to me.

Ex. 58.—1. *Ἡμεῖς μὲν γράφομεν, ὑμεῖς δὲ παίζετε.* 2. *Νὼ μὲν γράφετον, σφὼ δὲ παίζετον.* 3. *Ὑμᾶς τιμῶ, ὦ θεοί.* 4. *Ἡμῶν ἄκουε, ὦ παῖ.* 5. *Θεος ἀεὶ ὑμᾶς βλέπει.* 6. *Εἰ ἐγὼ βλάπτω ὑμᾶς, οὐ συγχαίρετε ἐμοί.* 7. *Σὺ συγχαίρεις ἡμῖν.* 8. *Ἑκὼν ὑμῶν, ὦ τοκεῖς, ἀκούομαι.* 9. *Ὁ πατὴρ στέργει ἐμέ τε καὶ σέ.* 10. *Ὑμᾶς ἀμφοτέρους ἡ μήτηρ στεργει.* 11. *Ἐμοῦ ἐστι φυλάττειν τὸν οἶκον, ἐγὼ γὰρ εἰμὶ ὁ φύλαξ τοῦ οἴκου.* 12. *Σοῦ ἐστιν, ὦ παῖ, μανθάνειν σπουδαίως.* 13. *Ἡ λύρα παρέχει ἡδονὴν σοὶ καὶ ἐμοί.* 14. *Σφῷν ἐστι φίλος πιστότατος.*

Ex. 59.—1. Life brings many painful things with it. 2. Know thyself. 3. Wish to please all; not thyself alone. 4.

The wise man carries about his property in himself. 5. Utter the praise of thy friends rather than thine own. 6. Virtue is honourable in itself. 7. The greedy enrich themselves, but injure others. 8. The incontinent are not only injurious to others without being profitable to themselves, but are doers of evil to others, and much more so to themselves. 9. We gratify ourselves with most pleasure. 10. The gods are free from envy, even amongst one another. 11. Bad men injure one another.

Ex. 60.—1. Οἱ σοφοὶ περιφέρουσι τὰ πράγματα ἐν ἑαυτοῖς. 2 ʽΟ πλεονεκτης ἑαυτὸν πλουτιζει ἄλλους δὲ βλάπτει. 3. ʽΥμᾶς αὐτοὺς χαριζεσθε. 4. ʽΟ ἀκρατὴς οὐκ ἔστι τοῖς μὲν ἄλλοις βλαβερος, εαυτῷ δὲ ὠφελιμος· ἀλλὰ κακοῦργος μὲν τῶν ἄλλων, ἑαυτοῦ δὲ πολὺ κακουργοτερος. 5. ʼΑγαθοὶ παῖδες, ἀλλήλους στεργετε.

ARCHITECTURE.—I.

INTRODUCTION.

ARCHITECTURE has been defined as "the art of building"; it might more correctly be termed "art in building," for it is precisely when artistic qualities are found in a building "when," as Sir Digby Wyatt says, "the structure is reared for something beyond the immediate wants of the individual who erects it, and the first idea of giving it embellishment comes into existence," that it may claim to be a work of "architecture" as distinct from "building." Architecture is said to be a creative art in that the forms produced are not found in nature; whereas, in painting and in sculpture, imitation of nature or of its impressions is the first characteristic. This is only partially true. In its first stage, architecture (and it would be more correct to say building) is creative; in its second stage it may be imitative; not, however, of nature, but of the forms created in building.

The earliest habitations of man were probably erected in the alluvial plains of great rivers, and, in the valley of the Nile, were raised in crude or sun-dried bricks. Their walls were built of greater thickness at the bottom in order to be able to support the superincumbent weight; that portion of the wall of the house which rose above the doorway or other opening had to be supported by a beam of timber of some kind, probably the trunk of a palm tree, the arch and its principles not then being known. The space enclosed for the house had also to be covered over with palm-tree trunks laid side by side and coated with mud to protect the interior from the heat of a tropical sun.

So far all is creative, the forms evolved not being found in nature; and this brings us to the second stage—the imitative. Some of the earliest tombs in Egypt are those found near the Great Pyramids and at Sakhara; they are sometimes excavated in the solid rock, sometimes cut out in the side of a cliff. These tombs consist of one or more chambers which might be correctly termed sepulchral chapels, for the body was laid in a pit or well at a lower level, and the chambers served apparently as reception rooms for the relatives of the deceased who came to make their offerings at his tomb. So far there is nothing remarkable, but here the artist steps in: he is anxious to suggest that this chamber, the reception room, is representative of the house the deceased formerly lived in. Above the doorway he carves in the solid rock an imitation of the palm-tree trunk, put there in the crude brick dwelling to carry the wall above; on the ceiling he reproduces the palm-tree trunks laid side by side to cover over the space, and which carried the mud covering; on the outer face of the chapel he copies that sloping or raking line which existed in the crude brick dwelling where the walls were thicker at the bottom, and various other features which were essentially constructional and creative in the first stage, are imitated and made use of in the second as a decorative embellishment. These were the first germs of architectural thought. It is true that we have assumed the prior existence of such crude brick structures—structures which a single rainy day in England would consign to the ground, but which in Egypt, owing to the absence of rain, last for centuries: at the present day behind the temple of the Ramesseum at Thebes are to be found the granaries built by Rameses the Great in the fourteenth century before Christ. The same traditional method of building also is carried on down to the present day, and the huts of the fellaheen or poorer people of Egypt are still built in sun-dried bricks, and their roofs still formed of palm-tree trunks, just, in fact, as they would seem to have been in the earliest days of her civilisation, if we may judge by the stone imitations found of them in the tombs above described, which date some 3,000 years before Christ. Contemporaneous with these tombs are others of a far richer type, the tombs of the higher personages of the realm, and the fronts of these tombs seem to have been carved

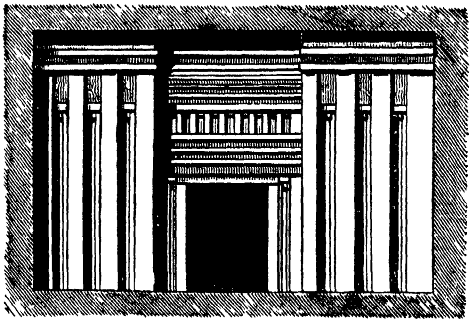


FIG. 1.—FAÇADE OF A TOMB, EGYPT.

in imitation of a kind of trellis work of wood consisting of vertical stiles of timber tied together by horizontal rails (Fig. 1), which are suggestive of a framework of timber employed to support and protect the crude brick walls of more important dwellings, the brick wall being always necessary to keep out the heat.

In like manner at a later period we find in the tombs of Beni-hassan, also in Egypt, cut in the face of the rock, an imitation of an eaves roof (viz., that projection of a roof which is formed to give protection to the wall), and on the soffit, or underneath part of the eaves (Fig. 2), are carved in bold relief the rafters which in the original building carried the roof. Inside other tombs, also cut in the solid rock, we find slender pillars or piers left, which are carved in imitation apparently of the wooden posts of a hut or tent decorated with lotus (Fig. 3), and other river plants. In the features we have just described we have the prototypes of most of the features which characterise the architecture of Egypt · the raking line is found in all the pylons, or gateways, and in the wall of all the temples, and the lotus column and other varieties constitute the method by which they decorated the columns which carried the stone beams of their roofs.

It would be possible to go farther, and in the tombs of Lycia in Asia Minor (two of which are in the British Museum), to point out how the artist has cut in the solid rock features derived from earlier wood constructions, whilst even in the Parthenon and other buildings of the Doric order in Greece most of the superstructure constituting the roof has derived its decorative forms and details from buildings of wooden origin.

So far we have been dealing with the archaic forms of primitive styles more or less uninfluenced by other contemporaneous or earlier forms of architecture. The task becomes more complicated when we have to deal with later styles, such as in the Roman or Romanesque styles, where the artists have endeavoured to reproduce forms known only to them by tradition, from early recollections, or from vague descriptions of buildings erected in other countries. Such copies and imitations, generally of a debased character when compared with the original types, contain frequently in them the germs of a new style; and the very fact of these builders having been obliged to exercise their own imagination in the adaptation of such forms to new requirements has led to novel combinations and to the conception of original decorative features which were not thought of in the constructions they imagined they were copying.

The development of architectural style, therefore, may be said to be due:—

1st. To an attempt to copy or imitate in another material a form already created, employing the constructional as decorative features, or otherwise.

2nd. In the creation of new forms required by the growth of civilisation and its extended demands.

3rd. To the necessity for employing the materials at hand, which often were very different from those of the models they attempted to copy, or which an advance in scientific knowledge enabled them to utilise in a different way.

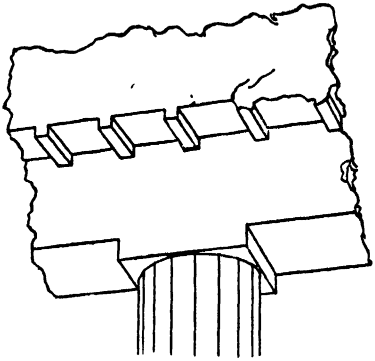


Fig. 2.

And 4th. To the extraordinary impulse which this third cause seems to have exerted at certain periods of the world's history. The greatest and the most rapid strides in architectural style have been made by the discovery and research involved in some new method of construction. Thus in Rome the invention of the large bricks or tiles, and the great strength and cohesion of concrete or mortar mixed with puzzolana, a volcanic earth, enabled the Roman builders to employ arched forms in vaults of a span and dimension undreamt of in earlier times, though the arch had long been known. The invention of carrying a dome on pendentives, realised in the church of St. Sophia at Constantinople by the Byzantine architects, virtually created the Byzantine style. The great problem of the concentration of thrust and counter-thrust in the vaults of Romanesque architecture, which was brought to its climax by the invention of the pointed arch, and its constructional value in the vaulted roofs of churches in the twelfth century in France, led almost immediately to an extraordinary development of architectural style, so that, not only in France, but in England, Spain, Italy, and Germany, the next three centuries witnessed the erection of stupendous structures containing more scientific knowledge, greater powers of invention, and more infinite variety than had ever been conceived in all the earlier styles; and lastly, within our own century, the development of the use of iron for every kind of constructive requirement has completely revolutionised all the ancient styles, and placed us for the moment in a transitional period, the ultimate development of which we are still unable to divine.

We shall in the course of our lessons take up one by one a description of the several styles of architecture. It has been the custom to distinguish between the earlier styles down to the end of the fifteenth century, and those phases of style which have followed, by calling the former the true styles, and the latter the imitative styles. If, however, there be any degree of reason in the argument we have laid down, all the styles have been imitative in their archaic state, progressive in their perfected state, and decadent in their later phases, and the death of one has, under altered conditions of religion, race, or country, become the birth of another. Between the earlier styles known, and those which have been growing during the last four centuries, however, there are certain very essential points of difference. The revival of letters in the fifteenth century, and the invention of printing, led to two, at least, very important changes:—

1st. The estrangement from architecture of a very large class of intellectual persons, who henceforth elected to teach mankind through the printed book instead of recording them in the temple or cathedral.

2nd. The creation in men's minds of a revival in favour of the earlier styles of architecture, of the Greek and the Roman (the only ones then known), caused by the printing of the classic authors, who described and expatiated on them in such glowing terms, that not only in Rome, but through Italy, it equalled the impulse generated by a new creation. Instead of improving upon and gradually developing to new requirements the traditional style of the country, they stepped back twelve centuries or more to copy the forms and features of an antique style. In Italy, and in those parts of Europe where the remains of Roman buildings were still preserved, these might have been copied with more or less exactness, and in process of time have become so changed that it would have been difficult to trace their origin. The same had occurred before, and the Romanesque builders in Italy, from the fourth to the fourteenth century, probably imagined they were always building after the Roman manner; but then another element came to the fore; with printing came in also illustrations of ancient buildings: the architect had no longer to trust to his memory or to his imagination, he had the copy-book before him; and these were taken to other countries whose architects deemed it not only necessary to visit Rome and Italy, but on their return also to publish works containing illustrations of the chief buildings of antiquity they had seen. This new field of knowledge has gradually been spreading, so that in this century we are all more or less acquainted, not only with all the forms and details of the great Roman styles, but with almost every development of art which has existed in the world's history; and quite lately the further invention of photography and increased facilities of travel have flooded the present generation with such a plethora of wealth in architectural forms, that many years, if not centuries, will be required to absorb and digest it.

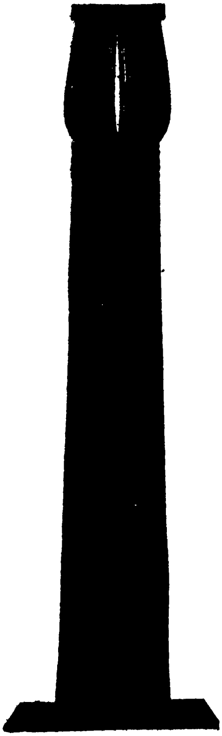


Fig. 3.—Lotus Column.

We have endeavoured, so far, to lay before our readers some of the causes which underlie the growth of the various styles of architecture, and we propose to take these up in a series of lessons, and to draw attention to the principal forms developed in each style.

The styles of architecture may be divided broadly into two classes—1st, those which have directly or indirectly influenced the origin and the development or growth of those buildings, features, or forms which are found in Europe, and more particularly in our own country; and 2nd, those which have been formed independently, unswayed by European architecture—art having exercised no influence on it.

Belonging to the first class we have, more or less in chronological order: the Egyptian, Assyrian, Persian, Greek, Roman, Byzantine, Saracenic, Romanesque, the Gothic or pointed styles, and finally under the influence of the revival of letters in the fifteenth and sixteenth centuries, the Renaissance or Italian style.

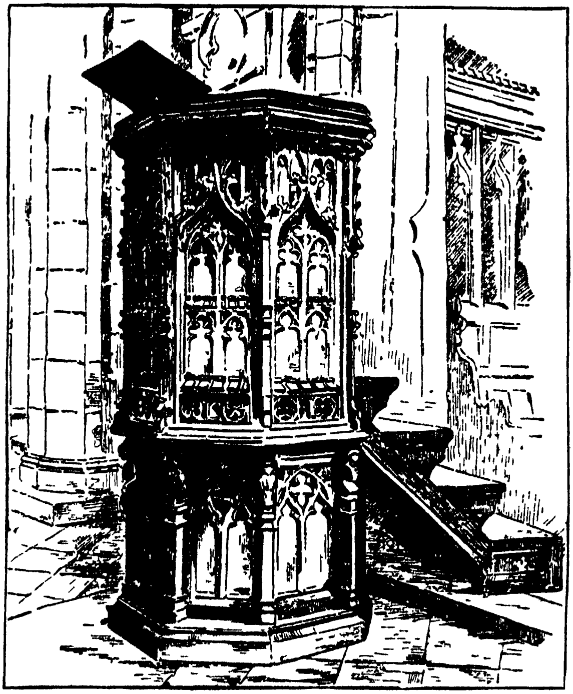
Of the second class we have, in India the Buddhist, the Jaina or Hindu, the Dravidian and Palukyan; the Chinese and Japanese; and finally the Mexican, a style completely apart by itself, and apparently uninfluenced by any other.

ENGLISH LITERATURE.—III.

[*Continued from p.* 188.]

CHAUCER AND HIS TIMES.

From whatever point of view it be regarded, the reign of Edward III. must always be one of the most important epochs in the history of England; but to the student of literature it is especially so.



The Wiclif Pulpit, Lutterworth.

Long before this time—indeed, for centuries—a gradual fusion must have been in progress between the two races, Norman and Saxon. The memories of the Conquest, and the oppression which followed it, were fading. The spirit of haughty contempt on the one side and of bitter hatred on the other, had gradually passed away. The Norman nobles and the older Saxon families had become assimilated in privileges and position; and throughout all classes the diversities of race were beginning to be forgotten. The English language, too, was little by little conquering in the struggle with its rival, the French, and becoming the language of the whole people. We are told by the old chroniclers that down to the fourteenth century, and during at least a great part of it, French was the language of the grammar-schools, and even Latin was taught to English boys through the medium of the French. But we read that one John Cornwal introduced the system of teaching in English, and being followed by others who learnt of him, the practice soon spread, and ultimately became universal. From some time after the Conquest, French had been the language of the courts of law; but in 1362 an Act was passed substituting English for it; and the very significant reason is given in the preamble, that the language of the courts was no longer understood by the parties to the causes. The fire necessary to complete this fusion of different elements into a single nation was supplied by the French wars of Edward III. For the first time England as a nation was called upon to measure her strength against one of the great nations of the Continent; and her success was brilliant. The enthusiasm of war and the pride of victory gave birth to a spirit of nationality, which was the one thing needed to complete the unity of the nation. And the fact that the national enemy was France, with the hatred of things French thence arising, must have decided the victory of English as the national language over its French rival.

But it was not in foreign war alone that England in that day showed that men's energies had fully awoke from the sleep of the dark ages; nor was such a revival confined to England. Everywhere in Europe old forms of faith were being sternly questioned. Old systems of philosophy were cast aside. Old institutions and social organisations were giving place to new. It was the age that saw the death of the scholastic philosophy and of the system of chivalry. It saw the revival of ancient learning, the first real efforts to throw off the corruptions of religion both in doctrine and in practice, and the commencement of modern literature. In England, the religious reformation attempted under Wiclif, on one side; and on another side the rising spirit of the poorer classes, still burdened under the yoke of feudalism, a spirit which soon after led to the great rising of the commons under Wat Tyler, showed that England had participated in the general movement. But till the time at which we have now arrived—that is to say, the fourteenth century—she was behind the rest of Europe in literature. In Italy, Dante had produced his great work in the beginning of the century. Petrarch and Boccaccio had written since. In other countries, too, much had been done. But, as we have seen, England was still without a literature. Now, however, everything was in her favour. Her national unity was achieved; her language was practically formed; the mental energy was present; and the desire for knowledge was so universal, we are told on authority which it is difficult to disbelieve, that at Oxford and Cambridge the students might then be counted by thousands where they now are by hundreds.

From comparatively early in the reign of Edward III., we find signs of the revival of a national spirit in the popular songs on subjects of national interest. Among these the most important which have been printed are a series of ten very spirited ballads by Laurence Minot, upon various battles and other achievements of Edward III.

But the first work of considerable extent and merit which demands our attention is the remarkable allegorical and satirical poem, "The Vision of Piers Ploughman" We treat this as the first because, though the year of its composition cannot be exactly fixed, it belongs in form and style so much more to the preceding age than any other great poem of the period, and shows so much less trace of the direct action of foreign influence, that it naturally takes the first place in order among the poems of the age of Chaucer. The author of "The Vision of Piers Ploughman" is said, and there is no reason to disbelieve it, to have been William Langland, probably a native of Oxfordshire, who lived as a monk at Malvern; and his placing the scene of his vision in the Malvern hills seems to confirm a part, at least, of the story.

This singular poem relates a dream, or rather a series of dreams, in which the poet sees, allegorically, the corruption and misery of the world; the remedy for those evils in the pursuit of truth; and the one guide to truth and regenerator of the world in the person of Piers, or Peter, the Ploughman. The world is a field full of people. Here are the poor toiling; the rich wasting; the lawyers pleading for hire; the clergy idle and corrupt; the pardoners deceiving the people for gain; yet all the while the castle of truth stands just above them, though they see it not. At court mede (corrupt gain), and falsehood, and wrong, contend with conscience, and peace, and reason; and lawyers, and confessors, and counsellors are on the side of wrong. At last Reason makes her voice heard in the world. Men are brought to confess their sins; each of the vices in turn comes to confession; and a great multitude set out upon the quest of Truth. But who shall show the way? Friars and pilgrims know it not. Peter, a ploughman, presents himself as the guide to Truth. But we very soon see that under the guise of the ploughman the poet presents to us none other than the Divine Redeemer of the world. Then we find Peter the Ploughman employing his followers in labour upon the field which he tills (the world). We see him ploughing the soil and sowing the seed of Divine grace. While side by side with this we have another allegory of "Do Well, Do Bet, and Do Best," three degrees of moral excellence, and the guides and instructors of the soul. The poem ends somewhat abruptly—so much so that some have thought it unfinished—with the ravages of Antichrist in the kingdom of Peter the Ploughman. We have said enough to enable the student to appreciate the general character of the religious lessons which the writer seeks to convey, and of the allegorical form in which he clothes them. But the poem is no less a satire than a religious allegory. The vices of all classes of men are painted with much vigour; but above all the corruptions of the clergy and the monastic orders, their idleness and neglect of their flocks, their covetousness and simony, their self-indulgence, their deceptions to extract money from the people. The world as it was and the world as it might be, the Church as it was and the Church as it ought to be, are put before us in constant contrast.

The language of Langland is decidedly more antique in cast than that of Chaucer. But what more than anything else connects this poem with the past, rather than with the future, is its metre It bears every mark of having been written distinctly for the people, rather than for the cultivated classes. And, perhaps, for this reason the author chose for it the old Saxon alliterative metre, which seems to have been then still habitually used, and even long afterwards sometimes occurs, in the songs of the people. The chief peculiarity of that metre is that in each couplet, or pair of verses, two or more accented—that is, emphatic—syllables in the first line, and one in the second, begin with the same letter. The character of the metre will be learnt more easily from the specimen which we give than from any amount of description. It will be observed that it differs from our modern metres in having alliteration—that is to say, identity of initial letter in syllables—instead of rhyme; and in attending not to the number of syllables in a line, but rather to the number of

JOHN WICLIF.
(*From the Portrait at King's College, Cambridge.*)

accents. But it must be observed that the alliterative principle is not unfrequently departed from in individual lines. After the dreamer has described his leaving his home and falling asleep, he begins to tell his dream as follows. We merely alter the spelling in some cases where it differs from our present spelling :—

"Then I gan meeten
A marvellous sweven,[*]
That I was in a wilderness,
Wist I never where,
And as I beheld into the east[†]
On high to the sun
I saw a tower on a toft,[‡]
Wonderfully imaked,[§]
A deep dale beneath,
A dungeon therein
With deep ditch and dark
And dreadful of sight.
A fair field full of folk
Found I there between
Of all manner of men,
The mean and the rich
Working and wandering
As the world asketh,[||]
Some putten[¶] them to the plough,
Playeden them[**] full seldom,
In earing[††] and in sowing
Swinkin[‡‡] full hard."

The great popularity which this poem attained is attested, not only by direct evidence, but by the number of imitations to which it led, the most notable of which was "The Creed of Piers Ploughman."

While, however, Langland, in his remote country home, was satirising the corruptions in practice which he saw in the Church around him, in a very different sphere had arisen one whose attack was of a far bolder kind; for it was directed, not only against the prevailing habits of life, but against the received system of doctrine as well.

John Wiclif was born about the year 1324, in a small village near Richmond, in Yorkshire. He received his education at Oxford, having been a member first of Queen's College, and afterwards of Merton College. At Oxford he very soon made a name for himself as a man of profound learning, extreme acuteness of intellect, and fearless courage. He first acquired popularity and fame by leading the opposition to the Mendicant Friars, who at Oxford, as elsewhere, were seeking to draw all wealth and influence into their own control. His lectures on divinity were frequented by multitudes of students. Nor was his fame limited to Oxford. He was consulted by Edward III. upon the great question then pending between England and the Pope, as to the payment of tribute claimed by the Papal Court by virtue of the cession of the kingdom in the time of King John. And he was one of those sent by the king to meet the Papal legate at Bruges, and negotiate with him upon this subject. His chief supporter at Court was John of Gaunt, Duke of Lancaster. After his return from his foreign mission, he was appointed to the rectory of Lutterworth, in Leicestershire. As time went on, and his knowledge and observation were enlarged, his opposition to the existing order of things both strengthened and widened. From an opponent of practical abuses, he had gradually become an opponent of some of the most cherished doctrines of the Church—that as to transubstantiation, for example. He had drawn to himself, too, a multitude of followers, and organised a body of preachers, who spread his opinions through the whole country. He had become the head of a great movement. It was hardly to be expected that such an adversary should be left unmolested by the heads of the Church. Just before the death of Edward III., he was summoned before the Archbishop of Canterbury at St. Paul's. But the proceedings came to nothing; Wiclif was rescued from danger by John of Gaunt. With the accession of Richard II. the power of John of Gaunt declined. Then followed the rising of the commons under Wat Tyler, in 1381, which was ascribed by his enemies to the revolutionary influence of Wiclif's teaching. His bitterest foe, Courtenay, had become Archbishop of Canterbury.

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[*] Dream.
[†] Looked to the east.
[‡] Field.
[§] Wonderfully made.
[||] As the world requires.
[¶] Applied themselves.
[**] Amused themselves.
[††] Ploughing.
[‡‡] Laboured.

Wiclif was again summoned before a synod, which met at the Greyfriars, in London. He did not appear, but his doctrines were condemned as dangerous and heretical. By the Convocation at Oxford he was again condemned. No actual step was taken, however, against him, and he continued to preach and teach in his parish of Lutterworth as boldly as before, until, in the year 1384, two years after his condemnation, he died of paralysis.

Wiclif wrote much in Latin, addressed to the learned; and much in English, addressed to the people. His shorter English works consist of tracts upon subjects of temporary interest. His one great work was the translation of the Bible into English. This vast undertaking was probably not accomplished by Wiclif unaided. No doubt a great part of it was executed by his followers and disciples under his supervision; but the design is unquestionably his; and there is no doubt that it was carried out in part by himself, and entirely under his direction and guidance. The first edition appears to have been completed three or four years before Wiclif's death. A second was finished by Purvey a few years after the death of his master. This is the first really great work in English prose; and when we consider the thirst for religious knowledge at the time it was produced, and the number of its author's followers both then and afterwards, we can scarcely doubt that, quite apart from his influence in other respects, Wiclif must have done more than almost any other man has ever done to fix the standard of the English language, and form the style of English writers.

John Gower was sprung of a family of knightly rank in the county of Kent. He was a man of property, and is said to have been educated at Merton College, Oxford, and afterwards to have adopted the profession of the law. However this may be, it is pretty clear that he lived within the circle of the society of the Court. Many short poems of his have been recovered and published in various collections, some of them in French and some in Latin. But his larger works were three in number; and of these one was written in French, one in Latin, and one in English. The "Speculum Meditantis" ("Mirror of One Meditating)," which was in French, has been lost. The "Vox Clamantis," or "Voice of One that Crieth" (so called in allusion to St. John the Baptist), is a long poem in Latin, in which, partly under the form of allegory, he sets forth the evils of the time, especially the miseries attendant upon the great rising of the commons, under Wat Tyler, in 1381; and protests against the vices and corruptions of the various classes of society. Gower, however, was no friend or follower of Wiclif. But his latest and most important work is the "Confessio Amantis," or "Lover's Confession," a very long poem in English. Its form is that of a dialogue between the poet and Genius, a minister of Venus, who is assigned by her to receive his confession. The principal part in the dialogue is borne by Genius, the confessor, who lays down a number of moral precepts for the instruction of the penitent lover, and illustrates them by stories taken from all kinds of sources, ancient and modern, sacred and profane, aimed against the seven deadly sins. This book thoroughly justifies the title which Chaucer gave to his friend and brother poet, and which was afterwards repeated by a long succession of writers, "Moral Gower." It shows, as all Gower's works do, much cultivation, but little poetical genius; and to us it is interesting, as showing how far the influence of Chaucer had acted upon his own contemporaries, rather than very attractive for its own sake.

Sir John Mandeville tells that he was a native of St. Albans, and went abroad in the year 1322, on Michaelmas Day. He remained abroad some thirty years, visiting Egypt and a very large part of Asia; and, after his return, he wrote an account of the countries he had visited. The book is full of the wildest fables; indeed, it is plain that Mandeville had the true traveller's appetite for wonders, and received and recorded whatever was told him about the countries with which he came in contact. But his accounts of what fell under his own observation are clear and interesting. What he tells about the languages in which he published the book, and his reasons, is well worth noting, as illustrating the transition which the nation was then passing through in respect of language. "Ye shall undirstande (he says in his prologue) that I have put this boke out of Latin into Frensche, and translated it agen out of Frensche into Englyssch; that every man of my nacioun may undirstande it."

The greatest genius, however, and in every respect the most strongly representative writer of this period, was Chaucer.

Geoffrey Chaucer, the great poet of his age, was recognised as such during his life no less than after his death. Naturally, therefore, from the notices of him in the writings of his contemporaries, and from public documents, we know many details of his later life, enough to enable us to form a very fair picture of his circumstances and mode of living. But of his early life and the circumstances of his birth we are unable to learn much. As to his parents, little is known. He was the son of John Chaucer by his second wife Agnes; his father was a vintner and tavern-keeper, who dwelt in Thames Street, by Walbrook. We can infer that his father must have been moderately wealthy from the education which the son's works show that he must have received. There is little doubt that he was born in or about 1340. Some have said that he received his education at Cambridge, on the authority of a passage in his early poem, the "Court of Love," in which a visit to the court of Venus is related by one who calls himself "Philogenet of Cambridge, Clerk," by which title Chaucer is assumed to describe himself; some have said that he was educated at Oxford, but nothing certain is known. All that can be said with confidence about his education is that every page of his works shows him to have been a man not only of rare genius, but of high culture, possessing an extensive acquaintance both with literature and science.

LUTTERWORTH CHURCH. *(From a Photograph by Messrs. Taunt & Co., Oxford.)*

Chaucer, like almost all gentlemen of his day, seems to have spent some time in military service. In 1359 he was serving in France under Edward III, and was made prisoner. But he probably returned to England the following year. He soon afterwards married Philippa, daughter of Sir Payne Roct, a gentleman of Hainault in the service of the Queen. Chaucer's wife was a maid of honour to the Queen, and afterwards entered the service of Constance, the second wife of John of Gaunt, Duke of Lancaster. Thus probably began Chaucer's connection with the Court, more particularly with John of Gaunt. But this connection was no doubt strengthened by the fact that Chaucer's wife was a sister of the notorious Katherine Swyneford, who afterwards became the wife of John of Gaunt. It is certain that throughout nearly his whole career Chaucer attached himself steadily to the party of the Duke of Lancaster, and became his intimate friend and trusted adviser; and his fortunes rose and fell with the influence of his patron. In 1372 we find him employed on a public mission to Italy; and during this visit there is some reason to think that he became acquainted with Francis Petrarch. In 1374 Chaucer was appointed Controller of the Customs for the port of London. But, notwithstanding his holding this post, he still continued to be employed abroad from time to time upon various diplomatic missions, the precise nature of which cannot for the most part now be determined. In 1386 a commission was appointed to inquire into the alleged abuses in the Customs' Department, and Chaucer lost his post; and it is conjectured that after this event the poet's circumstances were straitened. In 1387 his wife died. In this distress he seems to have continued for some years, until in 1394 he received a pension from the King, which was subsequently increased sufficiently to place him in comfort. He died on the 25th of October, 1400, probably at his house in Westminster, and was buried in Westminster Abbey

Not only was Chaucer almost throughout his whole life brought into constant and close intercourse with some of the most eminent political and party leaders of his time, but he also appears to have lived on terms of intimacy with his brother poets and men of letters. Of these, as we have seen, the greatest was Gower, between whom and Chaucer a close friendship existed. His connection with John of Gaunt, too, brought him within the circle of the great religious movement brought about by Wiclif and his disciples. John of Gaunt was Wiclif's protector, and the Lancastrian party at that time leaned much upon the support of those large classes of the community who, like Wiclif, rebelled against the dominion and revolted against the corruptions of the regular clergy. Hence we can trace throughout the works of Chaucer—in his vigorous, and no doubt somewhat exaggerated, pictures of wealthy and self-indulgent abbots, dissolute monks, and lying pardoners, contrasted with his attractive sketches of the poor and pious parish clergy—his sympathy with the movement of the Reformers.

It will easily be seen that the times in which Chaucer lived and the circumstances of his career were peculiarly favourable for a great and original poet, and especially for one with Chaucer's unrivalled power of catching and reproducing the peculiarities in character and habit of different classes of men. Border countries are the favourite ground of picturesque writers. Types of character are more strongly marked and more sharply contrasted there than elsewhere. Thus Scott chose for his usual field the border-land between England and Scotland, or the dividing line of highland and lowland. And the age of Chaucer may well be called the border-land between the dark ages and the modern period. In his own great poem he brings together the knight who had fought for the Cross and the prosperous London merchant and the essentially modern country gentleman; and this was a true picture of the times.

So in the literature of that age, as we have already seen, the formal and learned Gower and the rough and antique satirist Langland were alike contemporaries of Chaucer; while in Italy Petrarch was writing poetry as polished and artistic as any that the world has ever seen. This was just the age in which the genius of Chaucer, with its singular variety of scope, and its power of seizing points of character, would find the fullest play; and Chaucer's varied career was entirely in his favour. As soldier, courtier scholar, diplomatist, and man of business, he must have had unusual opportunities of studying character and learning the real life of his age. And we find the character of his poetry in this respect just what we might expect to find it under these circumstances. The poet has left that marvellous photograph from real life, the prologue to the "Canterbury Tales"; and the genuine and simple pathos of the story of Griselda. The variety of character in the poetry of Chaucer keeps constantly before our minds that, though he is rightly called the source from which the stream of English poetry takes its rise, that source itself, like the great lake that feeds the Nile, derives its fulness not only from the springs that arise within its bosom, but from the streams whose waters it collects and makes its own. Some of the various channels of literature which converge in the works of Chaucer we have already pointed out, and we shall ask our readers to bear this observation in mind when we come to remark upon the poems of Chaucer singly.

Before proceeding to consider the poetry of Chaucer in detail, it is necessary to speak very shortly upon matters which have given rise to much controversy—the language in which he wrote, and the principle of versification which he adopted. Some writers have treated Chaucer as one who spoiled the purity of the English tongue by the wholesale introduction of French words into it; while others have regarded his works as the most perfect standard of the English spoken in his day. The truth appears to be that in the main Chaucer used the English language as it was usually spoken and written in his day by the aristocracy and among educated men, which would for obvious historical reasons be less purely Saxon and more mixed with French than the language of the lower orders. But it is also beyond doubt that Chaucer, in enlarging the range of ideas which were to be expressed in English poetry, must have found it necessary at the same time to enlarge its vocabulary, and that he did so by the adoption of words from the French. And though many words used by him have since been lost, and many more have been introduced, it is still true that the vocabulary thus formed is substantially the same as that now in use, though, of course, the spelling and the pronunciation have considerably changed, and some words have dropped out of use or have had their meaning entirely altered.

With regard to the forms of English words as written by Chaucer, a few points must be borne in mind by the reader, in order to a thorough understanding of the author. In its earliest form—the Anglo-Saxon—English was a language, like the classical Greek and Latin, with a complete system of inflections (*see English lessons*)—forming, for instance, the cases of its nouns by appropriate changes in their termination, instead of by the use of prepositions, as in the present day. In the English of Chaucer, though it was not so to the same degree in that of some of his contemporaries, these case-endings, except the *s* or *es* of the genitive, are lost, the rest being represented, if at all, by an *e* at the end of the word, which *e* is sometimes sounded and sometimes silent. In words of French origin, also, the final *e* is in Chaucer, as in French poetry, as often sounded as mute. The presence of the final *e* in many words in which it is no longer written, and the fact that this final *e* is habitually sounded as an additional syllable of the word, is the one strongly marked difference between Chaucer's English and our own so far as the noun is concerned. But it will be noticed by every reader of Chaucer that the sounding of the final *e* is by no means an invariable rule; indeed, it is probably quite as often silent, especially before a vowel or the letter *h*, from which it may be inferred that in Chaucer's day the older pronunciation was beginning to give way to the modern. Thus such words as *poore* (poor) and *time* are sometimes, as the metre shows, to be read as we pronounce them now, and sometimes as *poorè*, *timè*. In the verb, also, there are a few old forms still retained in Chaucer which we have now lost. Thus the infinitive of the verb, instead of being, as now, *to seek*, is more commonly *to seeken*, or *to seekè*. The plural of the present tense, instead of being *we*, *you*, or *they seek*, was generally *we*, *you*, or *hi seeken*, the still older form ending in *eth* being occasionally found. The imperative mood is not *seek*, but *seeketh*. In the past participle Chaucer still habitually retains the old prefix *i-* or *y-* (corresponding to the German *ge-*, as *gehabt*, from *haben*) at the beginning of the word. Thus he writes *itaught*, *ipinched*, *isett*, when we should say, *taught*, *pinched*, *set*. With the exception of these points, however, and some others of minor importance, the chief differences between Chaucer's English and our own are differences of spelling. And as the eye becomes accustomed to the older spelling, and the few antique grammatical forms become familiar, every student will find that he meets no greater difficulty in reading Chaucer than that which arises from an occasional obsolete word, for which a dictionary has to be consulted.

FRENCH.—XXXIV.

(*Continued from p.* 151.)

French Words which are similar in Spelling or Pronunciation, but differ in Meaning (*continued*).

French Words.	Meaning in English.
Taille, *nf.*	*size, stature, waist, figure.*
Taille, *nf.*	*tally-stick*; (feudal law) *villain tax*; (at cards) *deal*; (mus.) *tenor.*
Ter, *adv.*	*third house of the same number.*
Terre, *nf.*	*earth*; *the earth*; *land, estate.*
Tain, *nm.*	*foil, tinfoil.*
Teint, *nm.*	*complexion.*
Thym, *nm.*	(bot.) *thyme.*
Tan, *nm.*	*tan*; *tanner's bark.*
Tant, *adv.*	*so much, so many.*
Taon, *nm.*	(ent.) *ox-fly.*
Temps, *nm.*	*time.*
Tante, *nf.*	*aunt.*
Tente, *nf.*	*tent, pavilion.*
Tard, *adv.*	*late.*
Tare, *nf.*	(com.) *tare, waste*; *defect, blemish*; *fault*; (vet.) *curb.*
Taré, *adj.*	(com.) *spoiled, damaged*; *of a bad character.*
Taux, *nm.*	*rate, price, assessment.*
Tôt, *adv.*	*soon.*
Tendre, *adj.*	*tender.*
Tendre, *v.*	*to stretch, to bend, to strain, to set*; *to tend.*
Ténu, *adj.*	*tenuous.*
Tenu, *pp.*	*held, kept, bound.*
Tenue, *nm.*	*session, holding* (*of assemblies*); *attitude, dress, carriage, deportment, bearing, address* (*of persons*); *appearance* (*of troops*).
Terme, *nm.*	*term, end, termination, time, word, expression.*
Terme, *nm.*	*quarter's rent, quarter-day.*
Thermes, *nm. pl.*	*thermal baths*; (antiq.) *thermæ.*
Thon, *nm.*	*tunny-fish.*
Ton, *adj.*	*thy.*
Ton, *nm.*	*tone, voice, accent, manner.*
Tic, *nm.*	*knack, habit*; (med.) *tic.*
Tique, *nf.*	(ent.) *tick.*
Tirant, *nm.*	*string* (*of purses*); *boot-strap*; *cramp-iron*; *ship's draught*; *sea-gauge.*
Tyran, *nm.*	*tyrant.*
Tirer, *v.*	*to draw, to pull.*
Tiret, *nm.*	*dash, hyphen*; *slip of parchment.*
Toi, *pron.*	*thee, thou.*
Toit, *nm.*	*roof.*
Tore, *nm.*	(arch.) *torus.tore*
Tort, *nm.*	*wrong, injury, harm.*
Tournoi, *nm.*	*tournament.*
Tournois, *adj.*	*of Tours*; livre tournois, *one-franc piece coined at Tours.*
Toue, *nf.*	*ferry-boat.*
Tout, *adj.*	*all, every, whole.*
Toux, *nf.*	*cough.*
Trait, *nm.*	*arrow, dart, shaft, bolt, thunder-bolt, stroke, hit*; *trait*; *trace* (*of horses*); *ray* (*of light*).
Trait, *nm.*	*leash* (*of dogs*); *turn* (*of the scale*); *gulp, draught*; *dash, stroke of the pen*, (paint.) *touch*, *kerf* (*of a saw*); *feature* (*of the face*).
Traite, *nf.*	(com.) *bill of exchange, draft*; *stage, journey*; *trading*; *slave-trade.*
Traité, *nm.*	*treatise.*
Traite, *nm.*	*treaty.*
Tranchant, *adj.*	*sharp, cutting, peremptory, decisive.*
Tranchant, *nm.*	*edge* (*of cutting instruments*); *web* (*of coulters*).
Tranche, *nf.*	*slice*; *steak*; *rasher*; *edge* (*of books*); *period, set* (*of figures*).
Tranchée, *nf.*	*trench*; *drain*; *throes, pains*; *gripes, griping*; *cut, cutting*; *excavation.*
Trancher, *v.*	*to cut, to cut off*; *to decide, to settle.*
Tranchet, *nm.*	*shoemaker's knife*; *paring knife.*
Transparent, *adj.*	*transparent.*
Transparent, *nm.*	(paint.) *transparency*; *lines* (*for writing straight*).
Tribu, *nf.*	*tribe.*
Tribut, *nm.*	*tribute.*
Trop, *adv.*	*too much, too many.*
Trot, *nm.*	*trot* (*of horses*).
U.	
Un, *art. adj.*	*see* Hun.
Une, *art. adj.*	*see* Hune.
Ut, *nm.*	*see* Hutte.
V.	
Vain, *adj.*	*vain.*
Vin, *nm.*	*wine.*
Vingt, *adj.*	*twenty.*
Vaine, *adj. f.*	*vain.*
Veine, *nf.*	*vein*; (geol.) *seam*; *underground spring of water.*
Van, *nm.*	(agri.) *fan.*
Vent, *nm.*	*wind*; *gale*; *flatulence*; (hunt.) *scent*; *vanity, emptiness*; (artil.) *windage.*
Veau, *nm.*	*calf, veal.*
Vos, *adj.*	*your.*
Veille, *nf.*	*watching, watch*; *sitting up*; *eve*; *vigil*; *day before*; *point, verge.*
Veillee, *nf.*	*sitting up and working in company*; *night attendance upon the sick.*
Vieille, *adj. nf*	*old*; *old woman.*
Vielle, *nf.*	*hurdy-gurdy.*
Vénéneux, *adj.*	*poisonous* (*of plants, minerals, etc.*)
Venimeux, *adj.*	*venomous* (*of animals*).
Ver, *nm.*	*worm.*
Verre, *nm.*	*glass*; *drinking-glass.*
Vers, *nm.*	*plural of* Ver, *which see above.*
Vers, *nm.*	*line* (*of poetry*), *verse.*
Vers, *prep.*	*towards, about, to.*
Vert, *adj.*	*green*; *sharp*; *harsh*; *tart* (*to the taste*); *raw* (*of hides*); *hale, vigorous, robust* (*of old age*).

French Words.	Meaning in English.	French Words.	Meaning in English.
Vert, *nm.*	*green, green colour; grass, green meat.*	Ville, *nf.*	*town, city.*
Verdeur, *nf.*	*greenness, viridity; vigour, strength; sap; tartness (of wines); acrimony.*	Viol, *nm.*	*violation (of the person), rape.*
Verdure, *nf.*	*verdure, greenness; green; greens; pot-herbs.*	Viole, *nf.*	(mus.) *tenor violin; viol.*
Versant, *adj.*	*liable to be overturned (of carriages).*	Violer, *v.*	*to violate, to break, to infringe, to transgress.*
Versant, *nm.*	*declivity; slope, side (of mountains, etc.).*	Violet, *adj. nm.*	*violet-coloured; violet colour.*
Verseau, *nm.*	(astron.) *Aquarius.*	Voie, *nf.*	*way, road, track, path;* (nav.) *leak; width between the wheels of carriages.*
Verso, *nm.*	*back (of a page of a book);* (print.) *reverse, even page.*	Voix, *nf.*	*voice; vote, suffrage; singer.*
Verser, *v.*	*to pour; to pour out; to shed; to deposit (money); to overturn, to upset (of carriages); to be laid (of corn).*	Voir, *v.*	*to see.*
Verset, *nm.*	*verse (of the Bible).*	Voire, *adv.*	*indeed, and, even.*
Vice, *nm.*	*vice, fault, defect, blemish.*	Vol, *nm.*	*flight; flying; soaring.*
Vice, *Latin prefix.*	*vice;* vice-amiral, *vice-admiral.*	Vol, *nm.*	*theft, robbery, robbing, larceny.*
Vis, *nf.*	*screw.*	Vole, *nf.*	*vole (at cards).*
Vil, *adj.*	*vile, base, mean, despicable, low, wretched, villainous.*	Voler, *v.*	*to fly, to fly about; to fly, to fly at, to chase (of birds).*
		Voler, *v.*	*to rob, to steal.*
		Volet, *nm.*	*window-shutter; dove-cot; ledge (of pigeon-house);* (bot.) *water-lily.*
		Voleter, *v.*	*to flutter.*
		Volter, *v.*	(fenc.) *to make a volt.*

FRENCH AND ENGLISH WORDS WHICH ARE SIMILAR IN FORM, BUT DIFFER IN MEANING.

English Words.	French Equivalents.	French Words.	English Equivalents.
Actually,	*réellement, effectivement, véritablement.*	**Actuellement,**	*now, at this moment.*
Addresser, *n.*	*pétitionnaire.*	**Adresser,** *v.*	*to direct, to address.*
to Advise,	*conseiller, donner avis de.*	**Aviser,** *v.*	*to apprise, to espy; to consider.*
Agreement,	*accord; rapport; convention; bonne intelligence; conformité.*	**Agrément,**	*approbation, consent; agreeableness, pleasingness; pleasure; gracefulness; amusement;* (mus.) *grace.*
Altered,	*changé.*	**Altére,**	*thirsty.*
Amends,	*dédommagement, réparation.*	**Amende,**	*fine, penalty.*
Ampliation,	*ajournement d'un jugement criminel.*	**Ampliation,**	*duplicate, copy of orders, sentences passed by law courts, of title-deeds, etc.*
Amuser, *n.*	*amuseur.*	**Amuser,** *v.*	*to amuse.*
Apprehender, *n.*	*celui qui opère une arrestation; penseur.*	**Appréhender,** *v.*	*to arrest, to take into custody; to fear, to apprehend.*
Arm, *n.*	*bras.*	**Arme,** *nf.*	*weapon.*
As, *conj.*	*comme, que, car.*	**As,** *nm.*	*ace (cards, dice).*
to Attend,	*accompagner; écouter; servir, soigner; s'occuper de; faire attention.*	**Attendre,**	*to await; to wait for.*
Attendant, *n.*	*assistant; serviteur; compagnon; suivant; personne de la suite.*	**Attendant,** *pp.*	*waiting for; awaiting.*
Attirer, *n.*	*celui, celle qui habille, qui pare.*	**Attirer,** *v.*	*to attract.*
to Avert,	*détourner; éviter; éloigner.*	**Avertir,** *v.*	*to warn, to caution.*
Axe,	*hache.*	**Axe,**	*axis; axle, axle-tree;* (artil.) *trunnion.*
Bachelor,	*célibataire, garçon; bachelier.*	**Bachelier,**	*bachelor of a university, graduate.*
Back,	*dos.*	**Bac,**	*ferry-boat.*
Bag,	*sac.*	**Bague,**	*ring (for the finger).*
Bail,	*caution; cautionnement.*	**Bail,**	*lease.*
Bailer or **Bailor,**	*déposant.*	**Bailleur,**	*lessor.*
		Bâilleur,	*yawner, gaper.*
Balance,	*équilibre; contrepoids.*	**Balance,**	*balance (scales), pair of scales; balance (of account); balance-sheet;* (astron.) *Libra.*
Balancer, *n*	*peseur; celui qui balance.*	**Balancer,** *v.*	*to balance; to swing; to hesitate; to counterbalance; to square accounts.*
Ballot,	*boule; bulletin (scrutin).*	**Ballot,**	*bale, package.*
Beck,	*signe de la main, de la tête.*	**Bec,**	*beak; bill; nib; rostrum; gas-burner; snout; spout; socket.*
Billet,	*bûche;* (her.) *billette; billet; billet de logement.*	**Billet,**	*note; letter; bill, handbill; label; promissory note; billet (quartering of soldiers).*
to Bless,	*bénir.*	**Blesser,**	*to wound.*
Bond,	*lien, engagement;* (carp.) *assemblage; obligation; bon; entrepôt.*	**Bond,**	*leap, bound, jump.*
Bonnet,	*chapeau (de femme); bonnette* (nav., fort.).	**Bonnet,**	*cap (head-gear).*
Bribe,	*présent (pour corrompre); prix, appât.*	**Bribe,**	*great lump of bread;* pl., *scraps, pieces of meat; odd ends.*
Bride,	*fiancée, mariée.*	**Bride,**	*bridle, rein.*
Brig,	*brick* (nav.).	**Brique,**	*brick (for building).*
But, *conj.*	*mais.*	**But,** *nm.*	*aim; end; mark.*
Calmer, *n.*	*celui qui calme, qui apaise.*	**Calmer,** *v.*	*to calm, to appease.*
Campaign,	(milit.) *campagne.*	**Campagne,**	*country-fields; country-seat; estate; campaign;* (nav.) *cruise, voyage.*

English Words.	French Equivalents.	French Words.	English Equivalents.
Cane,	*canne; jonc.*	**Cane,** *nf.*	*duck.*
Canon,	*chanoine; canon (law of the church);* (print.) *canon.*	**Canon,**	*cannon, gun, artillery;* (*church*) *canon law; barrel (of a musket), etc.*); (print.) *canon; catalogue of saints.*
Cap,	*bonnet; casquette, barrette; chapeau(de cloche,de sonnette);* (nav.) *chouquet;* (horl.) *recouvrement.*	**Cap,**	*headland, cape, promontory;* (nav.) *head.*
Capon,	*chapon.*	**Capon,**	*mean fellow; coward; cheat; sneak;* (nav.) *cat-tackle.*
Car, *n.*	*char; chariot; nacelle (de ballon).*	**Car,**	*as, for.*
Carrier, *n.*	*porteur; voiturier.*	**Carrier,** *nm.*	*quarry-man*
Case,	*étui; enveloppe; caisse;* (print.) *casse; (of a watch) boite; cas; état; cause.*	**Case,**	*division,compartment; hut; pigeon-hole; point (at backgammon); berth* (nav.).
Cask,	*tonneau, baril, barrique.*	**Casque,**	*helmet; helmet-shell* (conch).
Casket,	*cassette.*	**Casquette,**	*cap (man's).*
Cassine,	(bot.) *viorne luisante.*	**Cassine,**	(milit.) *little isolated house that can serve as a post, hut, hovel;* (bot) *cassine.*
Cassis,	(conch.) *casque.*	**Cassis,**	*black currant; black currant-tree; black currant ratafia; gutter; drain.*
Causer, *n.*	*cause (person).*	**Causer,** *n.*	*to talk, to converse, to chat; to cause.*
Caution,	*avis; précaution; garantie.*	**Caution,**	*surety, security; bail; pledge; bailer.*
Cave,	*antre, caverne.*	**Cave,**	*cellar, wine-cellar; stake* (gambling).
Chagrin,	*depit, vexation.*	**Chagrin,**	*grief.*
Chair,	*chaise, siege; (professorship) chaire; (of a chairman) fauteuil; (railways) coussinet.*	**Chair,**	*flesh, meat; (of persons) skin.*
Chandelier,	*candelabre.*	**Chandelier,**	*candlestick.*
Char,	*ouvrage fait à la journée;* (icht.) *ombre.*	**Char,**	*car, chariot.*
Charger, *n.*	*grand plat; cheval de bataille; coursier.*	**Charger,** *v.*	*to load; to exaggerate; to lay it on.*
Chariot, *n.*	*coupé; char, char de guerre (des anciens).*	**Chariot,** *nm.*	*waggon, cart, wait.*
Chat, *n.*	*causerie; conversation.*	**Chat,** *nm.*	*cat.*
Chine,	*échine;* (cook.) *échinée.*	**Chine,**	*China (country).*
Choke,	*foin (of the artichoke).*	**Choc,**	*shock; clashing; encounter.*
Chose, *v.*	*choisis, choisit, choisîmes, choisîtes, choisirent.*	**Chose,** *n.*	*thing; object.*
Clause,	*proposition, membre de phrase; clause.*	**Clause,**	*condition, clause.*

English Words.	French Equivalents.	French Words.	English Equivalents.
Cloak,	*manteau.*	**Cloaque,**	*sink; heap, receptacle of filth; filthy person;* (anat.) *cloaca; common sewer.*
Clout,	*torchon, chiffon; tape, coup; piece pour raccommoder.*	**Clou,**	*nail.*
Coin,	*piece de monnaie; encognure;* (print., artil.) *coin; angle.*	**Coin,**	*corner; wedge; stamp, puncheon (for stamping coins and medals); quoin, coin.*
Colon,	(gramm.) *deux points;* (anat.) *colon.*	**Colon,**	*colonist, planter, settler;* (anat.) *colon.*
Come, *v.*	*viens, venez.*	**Comme,***conj.*	*as, like; in like manner.*
Command, *n*	*commandement, ordre; pouvoir, puissance.*	**Command,** *nm.* **Commande,** *nf.*	(law) *he who has charged another to purchase for him; principal.* *order to a tradesman for goods.*
to Commend, *v.*	*louer; recommander; commettre.*	**Commander,**	*to command, to order.*
Comment, *n.*	*commentaire.*	**Comment,** *adv.*	*how.*
Commenter, *n.*	*annotateur.*	**Commenter,**	*to comment.*
Complaint,	*plainte; maladie, mal.*	**Complainte,**	*plaintive popular song.*
Confidence,	*confiance; hardiesse.*	**Confidence,**	*telling a secret to another; the secret thus revealed.*
Conformer, *n.*	*celui, celle qui se conforme, qui obéit.*	**Conformer,** *v.*	*to conform; to comply.*
Confuter, *n.*	*refutateur.*	**Confuter,** *v.*	*to disapprove; to confute.*
Console, *n.*	*console.*	**Console,** *nf.*	*corbel; pier-table; bracket; console.*
Conspirer, *n.*	*conspirateur.*	**Conspirer,** *v.*	*to conspire, to plot.*
Consummation,	*fin, but; consommation.*	**Consommation,**	*consummation; consumption; destruction.*
Copier, *n.*	*Copiste.*	**Copier,** *v.*	*to copy.*
Corn,	*blé; céréales; cor (au pied).*	**Corne,**	*horn; dog's ear (in books); shoe-horn; outside rind (of horses' hoofs).*
Corner, *n.*	*coin, encognure, angle.*	**Corner,** *v.*	*to blow, to sound a horn; to wheeze; to tingle (of the ears); to be tainted (of meat).*
Coucher, *n.*	*oculiste.*	**Coucher,** *v.*	*to lay down; to put to bed; to lay low; to go to bed; to lie down.*
Countenance,	*figure, mine, physionomie, air.*	**Countenance,**	*capaciousness, capacity; posture, attitude, look, air, deportment;* (nav.) *burden.*
Courtier,	*courtisan.*	**Courtier,**	*broker, commission agent.*
Crane,	*grue; siphon* (tech); *grue (bird).*	**Crâne,**	*cranium, skull.*
Crier, *n.*	*crieur.*	**Crier,** *v.*	*to cry; to call out; to shriek, to scream.*

English Words.	French Equivalents.	French Words.	English Equivalents.
Crisper, *n.*	*celui, celle,* or *ce qui frisse, boucle ou crepe.*	**Crisper**, *v.*	*to shrivel, to contract; to shrink; to irritate (the (nerves); to fidget.*
Cross,	*croix;* (fig.)*revers, traverse.*	**Crosse**,	*(of bishops) crosier; butt-end (of muskets); cricket-bat; cricket (game).*
to Cross, *v.*			
Curate,	*vicaire.*	**Cure**,	*parson, vicar.*
Curer, *n.*	*guérisseur; (of meat) saleur.*	**Curer**, *v.*	*to clean (harbours, sewers, etc.); to pick the teeth.*
Dauber, *n.*	*barbouilleur.*	**Dauber**, *v.*	*to cuff; to drub; to banter, to jeer.*
Decanter, *n.*	*carafe.*	**Décanter**, *v.*	*to decant; to pour off gently*
Defiance,	*défi.*	**Défiance**,	*distrust, mistrust; diffidence.*
Defier, *n.*	*celui, celle qui defie.*	**Défier**, *v.*	*to defy, to challenge, to brave, to dare, to set at defiance.*
Defiler, *n.*	*corrupteur, ravisseur.*	**Defiler**, *v.*	*to file off; to unstring, to unthread.*
		Denier, *n.*	*denier (obsolete French coin = [illegible] of a farthing); money; rate of interest; (weight) scruple.*
Denier, *n.*	*celui, celle qui nie, denie.*		
		Dénier, *v.*	*to deny; to refuse.*
Dent,	*coche, creux.*	**Dent**,	*tooth, notch, cog.*
to Deride,	*tourner en dérision, railler.*	**Dérider**, *v.*	*to unwrinkle; to smooth.*
Derider, *n.*	*moqueur, railleur.*		
Deriver, *n.*	*celui, celle qui retire, puise, obtient.*	**Dériver**, *v.*	*to derive, to proceed from;* (nav.) *to drift; to get clear of the shore.*
Designer, *n.*	*dessinateur, inventeur;* (b.s.) *machinateur.*	**Désigner**, *v.*	*to designate; to appoint; to fix.*
Destitution,	*dénûment.*	**Destitution**,	*dismissal, removal (from office).*
Detester, *n.*	*celui, celle qui deteste.*	**Détester**, *v.*	*to detest.*
Devise, *n.*	*disposition testamentaire, testament; projet, invention, plan, expédient.*	**Deviser**, *v.*	*to talk, to converse, to chat.*
to Devise,	*disposer par testament; projeter, imaginer, inventer.*		
Difference,	*différence; (quarrel) dispute, différend.*	**Différence**,	*difference, odds; diversity, disproportion, contrast, disparity.*
Different,	*différent.*	**Différend**,	*quarrel, dispute, difference.*
Dilater, *n.*	*celui, celle qui dilate.*	**Dilater**, *v.*	*to expand, to distend; to dilate, to enlarge, to widen.*
Dire, *adj.*	*terrible, affreux, cruel.*	**Dire**, *v.*	*to say, to tell.*
to Distract,	*diviser; jeter dans la confusion, bouleverser; mettre hors de soi; detourner.*	**Distraire**,	*to separate; to subtract; to divert from; to entertain, to divert.*

English Words.	French Equivalents.	French Words.	English Equivalents.
Distracted,	*éperdu, bouleversé, hors de soi.*	**Distrait**,	*absent in (mind); inattentive, vacant, heedless.*
Distraction,	*division, séparation; déchirement, confusion, demence.*	**Distraction**,	*separation, subtraction; abstraction, absence of mind; recreation, relief, diversion.*
to Divert,	*détourner, distraire; faire diversion; divertir, réjouir, récréer.*	**Divertir**,	*to amuse, to recreate; to embezzle; to convert to one's own use; to divert.*
Doll,	*poupée.*	**Dol**,	(law) *deceit, fraud.*
Donzel,	*jeune domestique, page.*	**Donzelle**,	*damsel; loose woman.*
to Don,	*(of garments) mettre, rêvetir.*	**Donner**,	*to give.*
Dot,	*point.*	**Dot**,	*marriage-portion, dowry.*
to Dot,	*marquer de points; pointiller.*		
to Dote,	*radoter, extravaguer; aimer éperdument.*	**Doter**, *v.*	*to endow; to give a marriage portion, a dowry.*
Doter, *n.*	*radoteur; amoureux fou.*		
Doubler, *n.*	*doubleur.*	**Doubler**, *v.*	*to double.*
Dress, *n.*	*robe; habit; habillement, mise.*		
Dresser, *n.*	*habilleur, habilleuse; apprêteur; table de cuisine;* (med.)*externe.*	**Dresser**, *v.*	*to erect; to straighten; to raise; to lay (a snare); to make out accounts; to draw up (a report); to prick up (the ears); to train.*
Droll, *n.*	*plaisante, farceur.*	**Drôle**, *n.*	*scamp, rogue, rascal, scoundrel; sharp fellow.*
Education,	*education; élève, instruction.*	**Éducation**,	*good breeding; rearing (of animals); gentlemanliness, good manners.*
Enchanter, *n.*	*enchanteur, enchanteresse.*	**Enchanter**, *v.*	*to enchant, to delight.*
Encore,	*bis.*	**Encore**,	*yet, still, again.*
to Encore,	*bisser.*		
Endurer, *n.*	*celui, celle qui endure.*	**Endurer**, *v.*	*to endure, to suffer.*
Engager, *n.*	*celui, celle qui contracte un engagement.*	**Engager**, *v.*	*to engage; to induce; to invite; to enlist; to pawn; to pledge.*
		Ennoblir,	*to ennoble.*
to Ennoble,	*anoblir, ennoblir; illustrer.*		
		Anoblir,	*to raise to the peerage, to nobility.*
Epaule,	*épaule (d'un bastion).*	**Épaule**,	*shoulder; epaule (of a bastion).*
Equipage,	*équipage; équipement.*	**Équipage**,	(nav.) *crew; equipage.*
Ere, *prep., adv.*	*avant; plus tôt.*	**Ère**, *n.*	*era.*
to Exact, *v.*	*exiger.*	**Exact**, *adj.*	*accurate, correct, close; punctual; exact.*
Examiner, *n.*	*examinateur.*	**Examiner**, *v.*	*to examine; to inquire into, to inspect; to survey.*

English Words.	French Equivalents.	French Words.	English Equivalents.
Exigent,	*urgent, pressant.*	**Exigeant,**	*hard to please; exacting too much; troublesome; particular, unreasonable.*
Expensive,	*dispendieux, coûteux; depensier.*	**Expansif,**	*open-hearted; expansive; unreserved.*
Fat, *adj., n.*	*gras; gros; graisse, gras.*	**Fat,** *nm., adj.*	*coxcomb, fop; foppish, coxcombical.*
Fast, *adj., adv.*	*rapide, vite.*	**Faste,** *nm.*	*pageantry, pomp, display, vain show, ostentation.*
Fend, *v.*	*se défendre de; empêcher d'entrer; écarter, éloigner; parer.*	**Fendre,** *v.*	*to cleave, to split.*
Fender, *n.*	*garde-cendre.*	**Fendeur,** *n.*	*cleaver, splitter.*
Figure,	*forme; taille; tournure; figure;* (arith.) *chiffre.*	**Figure,**	*figure, form, shape; countenance;* (*cards*) *court-card; diagram; representation;* (mus.) *figured passage.*
File,	*lime* (*tool*); (*of papers*) *liasse; liste; collection* (*of newspapers*); (milit.) *file.*	**File,**	*row; rank, file* (milit.).
Filer, *n.*	*limeur.*	**Filer,** *v.*	*to spin;* (nav.) *to veer; to rope;* (milit.) *to file;* (*of cats*) *to purr;* (*of ships, stars*) *to shoot;* (*of light*) *to flare; to cut off; to take oneself off.*
Fin, *n.*	(icht.) *nageoire;* (*of a whale*) *barbe, fanon.*	**Fin,** *nf., adj.*	*end, conclusion; aim, view, intention; fine, thin, refined, cunning, sly;* (*of writing*) *small hand.*
Foin, *n.*	(fenc.) *botte, coup.*	**Foin,** *n.*	*hay; choke* (*of artichokes*).
to Foin, *v.*	*porter, allonger une botte.*		
Fond, *adj.*	*passionné; badin, folâtre; vain, fou, faible; indulgent, bon.*	**Fond,** *n.m.*	*bottom, ground; foundation; main point;* (paint.) *background;* (theat.) *back scene;* (min.) *underground;* (nav.) *flooring.*
to Fondle, *v.*	*caresser; gâter; dorloter.*		
For, *prep., conj.*	*pour; car.*	**For,** *n.m.*	*tribunal* (*conscience*).
Fool,	*sot, imbécile, insensé, idiot.*		
Foul, *adj.*	*sale; vilain; impur; infâme.*	**Foule,** *nf.*	*crowd, throng.*
Four,	*quatre.*	**Four,** *nm.*	*oven.*
Fumage,	*fouage.*	**Fumage,**	*manuring of land; colouring of silver wire; smoking of fish, meat; a kind of mushrooms.*
Fumet,	(hunt.) *fumées* (*of the stag*); *crottes* (*of the hare*).	**Fumet,**	*flavour* (*of meat, wine*); *raciness.*

English Words.	French Equivalents.	French Words.	English Equivalents.
Furniture,	*meubles, ameublement; appareil, équipage;* (print.) *garniture.*	**Fourniture,**	*supply, provision; furnishing, providing, supplying.*
Furrier,	*fourreur, marchand de fourrures.*	**Fourrier,**	(milit.) *quartermaster;* (fig.) *harbinger, forerunner, precursor.*
Gale,	*vent frais, coup de vent, brise, bourrasque.*	**Gale,**	*itch; scab; mange; scurf* (*of fruits, etc.*).
Game,	*jeu.*	**Gamme,**	(mus.) *gamut, scale.*
Gare,	*écouailles* (*coarse wool*).	**Gare,** *interj., nf.*	*look out! beware! wet dock;* (*railways*) *terminus; siding, shunting line.*
Gender,	*genre; espèce, sorte.*	**Gendre,**	*son-in-law.*
Gland,	*glande* (anat.).	**Gland,**	*acorn.*
Glue,	*colle-forte.*	**Glu,**	*bird-lime.*
Grape,	*raisin.*	**Grappe,**	*bunch;* (fig.) *vine.*
Gratify,	*satisfaire, faire plaisir, recompenser.*	**Gratifier,**	*to confer on, to bestow on; to attribute, to ascribe.*
Grief,	*chagrin.*	**Grief,** *nm., adj.*	*grievance, wrong, injury, complaint; grievous, grave.*
Gripe,	*poignée, prise, étreinte, serrement;* (nav.) *bas du taille-mer;* (fig.) *oppression, vexation.*	**Grippe,**	*fancy, whim, hobby; dislike;* (med.) *influenza.*
Groin,	(anat.) *aine;* (arch.) *arête* (*of the line of intersection of two vaults*); *brise-lames* (*made of wood*).	**Groin,**	*snout* (*of a hog*); (fig.) *ugly face.*
Guardian,	*tuteur* (*of minors*); *curateur; administrateur; gardien* (*protector*).	**Gardien,**	*keeper; jailer; turnkey;* (*protector*) *guardian; door-keeper.*
Habit,	*habitude, coutume;* (*dress*) *habit, habillement.*	**Habit,**	*coat; dress-coat; garment, dress.*
Hair,	*cheveu, cheveux; poil.*	**Haire,**	*hair-shirt; sackcloth*
Hall,	*salle; palais; barreau; vestibule, manoir.*	**Halle,**	*market; market-place, exchange.*
to Hiss,	*siffler.*	**Hisser,**	*to hoist, to hoist up, to heave, to heave up; to raise; to haul out* (*sails*), *to sway up* (*yards*).
Home,	*domicile; foyer domestique.*	**Homme,**	*man.*
If, *conj.*	*si; soit, soit que.*	**If,** *nm.*	*yew-tree; triangular stand for illumination lamps.*
Ill,	*mal; mauvais; peu; malade.*	**Il,** *pron.*	*he, it.*
Impair, *adj.*	*inconvenable.*	**Impair,** *adj.*	*odd, uneven* (*of numbers*).
to Impair, *v.*	*détériorer; affaiblir, alterer, délabrer; nuire à.*		

English Words.	French Equivalents.	French Words.	English Equivalents.
Incense, *n.*	*encens.*		
to Incense,	*encenser; courroucer, provoquer, exaspérer, irriter.*	**Encenser,**	*to incense (to perfume with incense).*
Ingenuity,	*habilete, talent, genie, art, caractère, ingenieux*	**Ingénuité,**	*ingenuousness, frankness, candidness, simplicity.*
to Injure, *v.*	*nuire a, faire tort à; blesser; porter atteinte; gâter;* (med.) *leser;* (surg.) *intéresser.*	**Injure,** *n.* **Injurier,** *v.*	*insult, wrong, injury;* (plur.) *abuse, insults.* *to insult, to abuse, to call names.*
Injurious,	*nuisible, blessant, injuste.*	**Injurieux,**	*abusive, offensive, reviling.*
Injury,	*tort, mal, préjudice, injustice, injure.*	**Injure,**	*insult, wrong, injury;* (plur.) *abuse, insults.*
Instructor,	*instituteur, professeur, précepteur.*	**Instructeur,**	*drill-sergeant.*
Interceder, *n.*	*intercesseur.*	**Intercéder,** *v.*	*to intercede.*
Jest,	*plaisanterie, facétie, bon mot.*	**Geste,**	*gesture, action, movement, sign.*
Jet,	(min.) *jais, jaiet;* (of water) *jet d'eau; jet.*	**Jet,**	*casting, throwing, throw; shoot, sprout; casting (smelting); tiller; jet (of water); new swarm of bees.*
Jole,	*joue;* (of a fish) *hure.*	**Geôle,**	*gaol, jail, prison.*
Jolly,	*gai, joyeux, gaillard.*	**Joli.**	*pretty.*
Journey,	*voyage.*	**Journée,**	*day-time (of duration of daylight); day's work; day's wages.*
Land,	*pays, terre, contree.*	**Lande,**	*moor, heath.*
Lard,	*saindoux.*	**Lard,**	*bacon*
Large,	*grand, gros.*	**Large,**	*wide, broad.*
Late,	*tard, tardif; ancien; dernier; décédé, feu; avancé* (of the hour).	**Latte,**	*lath.*
Lecture,	*discours, sermon, leçon;* (scolding) *mercuriale, semonce, sermon.*	**Lecture,**	*reading, perusal.*
Leg, Legs,	*jambe, jambes;* (of birds, insects, small animals) *patte;* (of boots) *tige;* (of poultry) *cuisse;* of furniture) *pied;* (of mutton) *gigot.*	**Legs,**	*egacy.*
Lever, *n.*	*levier; bascule.*	**Lever,** *v.*	*to lift, to raise, to heave; to levy, to rise, to get up.*
Librarian,	*bibliothécaire.*	**Libraire,**	*publisher, bookseller.*
Library,	*bibliothèque.*	**Librairie,**	*book-trade; bookseller's shop.*
Lime,	*chaux.*	**Lime,**	*file* (tool).
Lunatic,	*fou, aliéné.*	**Lunatique,**	*moon-struck; whimsical, fantastical.*
Lunette,	*lunette.*	**Lunette,**	*lunette; seat (of water-closet, close-stool); spying-glass; merry-thought (of a fowl); telescope;* (plur.) *spectacles.*
Maggot,	*asticot.*	**Magot,**	*magot, Barbary ape; booby; ill-favoured man; grotesque figure (of plaster, china, etc.); hoard of money, hidden treasure.*
Magnifier, *n.*	*verre grossissant; celui, celle qui exalte, panégyriste.*	**Magnifier,** *v.*	*to magnify, to extol, to exalt.*
Mail,	*maille* (coat); *malle, malle-poste* (coach); *courrier; depéche* (post-office).	**Mail,** *nm.* **Maille,** *nf.*	*mallet; mall (game, place).* *mesh; mail; haw (eyes of animals); obsolete French coin.*
Mall,	*gros maillet; mail (game, place).*	**Malle,** *nf.* **Mal,** *nm., adj., adv.*	*trunk; pedlar's box; mail, mail-coach.* *evil, ill; sickness; mischief; misfortune; bad; badly; wrongly.*
Mange, *n.*	*gale* (of dogs, etc.).	**Mange,** *v.*	*eat (thou) (imperative).*
Marry, *v.*	*marier; épouser, se marier.*	**Marri,** *adj.* **Mari,** *n.*	*sorry, vexed.* *husband.*
Marrier, *n.*	*marieur.*	**Marier,** *v.*	*to marry, to give in marriage; to perform the ceremony of marriage.*
Mat, *n.*	(of rush) *natte;* of straw) *paillasson.*	**Mat,** *nm. adj.* **Mât,** *nm.*	*mate, check-mate* (chess); *unpolished, dull.* *mast.*
Mechanic,	*artisan, ouvrier.*	**Mécanique,** *nf.*	*mechanics; mechanism; machine, machinery, piece of machinery.*
Merchant,	*négociant.*	**Marchand,**	*tradesman, shopkeeper.*
Mien, *n.*	*mine, air.*	**le Mien,** *pron.*	*mine, my own.*
to Mine, *v.*	*creuser, exploiter, une mine; employer de sourdes menées* (in order to injure someone).	**Mine,** *nf.*	*air, look, mien; mine (of metals); ore; source; store; an obsolete French measure = 75 quarts;* (antiq.) *mina.*
Miner, *n.*	*mineur, carrier.*	**Miner,** *v.*	*to undermine, to sap; to mine; to prey upon.*
Mire,	*boue, vase.*	**Mire,**	(artil.) *aim, sight, mark.*
More, *adv.*	*plus.*	**More,** or **Maure,**	*Moor.*
Net, *n., adj.*	*file.*	**Net,** *adj.*	*neat; net, nett; pure, unadulterated.*
Noise,	*bruit, tapage, fracas;* (in the ears) *tintement, bourdonnement;* (fig.) *éclat, retentissement.*	**Noise,**	*quarrel.*

English Words.	French Equivalents.	French Words.	English Equivalents.
Noter, *n.*	*annotateur; celui, celle qui remarque.*	**Noter**, *v.*	*to note, to note down; to mark, to observe, to notice, to take notice.*
Obeisance,	*révérence, salut.*	**Obéissance**,	*obedience.*
On, *prep.*	*sur.*	**On**, *pron.*	*we, you, they, people.*
Once, *adv.*	*une fois.*	**Once**. *n.*	*ounce* (*weight*); *ounce* (*jaguar*).
Or, *conj.*	*ou, soit.*	**Or**, *nm.*, *conj.*	*gold; now.*
Pain,	*peine; douleur, mal.*	**Pain**,	*bread.*
Pair,	*paire, couple.*	**Pair**,	*peer; equal.*
Pale, *n.*, *adj.*	*pieu, échalas;* (her., punishment) *pal; giron; sein; enceinte; pâle, blême.*	**Pâle**, *adj.*	*pale, wan, pallid.*
to **Pale**, *v.*	*pâlir, faire pâlir.*		
Pall,	*poêle, drap mortuaire;* (of an archbishop) *pallium; manteau.*	**Pal**, *nm.*	*pale* (*punishment*); *stake;* (her.) *pale.*
Pamphlet,	*brochure.*	**Pamphlet**,	*libel.*
Pannade,	*courbette* (*of horses*).	**Panade**,	*panada* (*soup*).
Parcel,	*paquet; parcelle, portion, partie; tas* (*in contempt, of a number of people*); *envoie.*	**Parcelle**,	*particle; portion, instalment.*
Part, *n.*	*partie, portion, part; rôle; parti; défense; livraison* (*of books, etc.*); *quartier,* (mus.) *partie;* (plur.) *talent, moyens.*	**Part**, *nf.*	*share, part, portion, concern, sule.*
to **Part**, *v.*	*partager, separer, diviser; casser; rompre; se separer.*	**Part**, *nm.*	(law) *new-born child.*
Pat, *n.*, *adj.*, *adv.*	*tape; à propos, tout juste; justement, à point.*	**Pat**, *nm.*	*stalemate* (*chess*).
to **Pat**, *v.*	*donner une tape.*	**Pât**, *nm.*	*food*(*for falcons*).
		Pâte, *nf.*	*paste, dough; constitution, temper; kind, sort;* (print.) *pief.*
		Pâté, *nm.*	*pie, pastry; blot* (*of ink on paper*); (print.) *pie;* (fort.) *pate.*
Pate, *n.*	*caboche; peau de la tête du veau;* (fort.) *pâté*	**Pâtée**, *nf.*	*paste* (*to fatten poultry*); *mess* (*for cats, dogs, etc.*).
		Patte, *nf.*	*paw* (*of dogs, cats, etc.*); *flap* (*of pockets*); *foot* (*of birds*); *leg* (*of insects*).
Pathos,	*pathétique, pathos.*	**Pathos**,	*fustian, rant;* (rhet.) *pathos.*
Physician,	*médecin.*	**Physicien**,	*natural philosopher, physicist*
Physic, *n.*	*médecine, remède.*	**Physique**, *nm.*	*natural constitution of man; exterior.*
to **Physic**, *v.*	*médicamenter; médeciner; droguer; guérir.*	**Physique**, *nf.*	*natural philosophy.*

TRANSLATION FROM FRENCH.

Jean Pierre Claris-de Florian was born in 1755 and was recommended by Voltaire as a page to the Duc de Penthièvre, who encouraged his taste for literature. His "Galatée" and his "Estelle" are graceful and witty pastorals. His "Fables" are his best known works. He was imprisoned during Robespierre's time for having written some verses in praise of Marie-Antoinette. He died in 1794.

LE CHÂTEAU DE CARTES.

Un bon mari, sa femme, et deux jolis enfants,
Coulaient en paix leurs jours dans le simple ermitage
Où, paisibles, comme eux, vécurent leurs parents.
Ces époux, partageant les doux soins du ménage,
Cultivaient leur jardin, recueillaient leurs moissons;
Et le soir, dans l'été soupant sous le feuillage,
Dans l'hiver devant leurs tisons,
Ils prêchaient à leurs fils la vertu, la sagesse;
Leur parlaient du bonheur qu'ils procurent toujours.
Le père par un conte égayait ses discours,
La mère par une caresse.
L'aîné de ces enfants, né grave, studieux,
Lisait et méditait sans cesse;
Le cadet, vif, léger, mais plein de gentillesse,
Sautait, riait toujours, ne se plaisait qu'aux jeux.
Un soir, selon l'usage, à côté de leur père,
Assis près d'une table où s'appuyait la mère,
L'aîné lisait Rollin: le cadet, peu soigneux
D'apprendre les hauts faits des Romains ou des Parthes,
Employait tout son art, toutes ses facultés,
A joindre, à soutenir par les quatre côtés
Un fragile château de cartes.
Il n'en respirait pas d'attention, de peur.
Tout à coup voici le lecteur
Qui s'interrompt; "Papa," dit-il, "daigne m'instruire
Pourquoi certains guerriers sont nommés conquérants.
Et d'autres fondateurs d'empire:
Ces deux noms sont-ils différents?"
Le père méditait une réponse sage,
Lorsque son fils cadet, transporté de plaisir,
Après tant de travail, d'avoir pu parvenir
À placer son second étage,
S'écrie: "Il est fini!" Son frère murmurant,
Se fâche, et d'un seul coup détruit son long ouvrage;
Et violà le cadet pleurant.
"Mon fils," répond alors le père,
"Le fondateur c'est votre frère.
Et vous êtes le conquérant."

APPLIED MECHANICS.—V.

[*Continued from p.* 157.]

PRACTICAL EFFICIENCY—REAL MECHANICAL ADVANTAGE AS FOUND BY EXPERIMENT—THE LAW OF A MACHINE.

In the foregoing lesson we examined some simple machines on the hypothesis that there was no friction, but it is generally of more interest to the practical man to consider the machine as it stands, and to take friction into account. To investigate mathematically what the *force* of friction is at each point in a machine at which rubbing occurs, would be a very tedious if not an impossible task. It is easy, however, to obtain, by experiment, results which show the general *effect* of friction, and to find forces which give the summation of a large number of smaller forces of friction acting at different parts and in different directions throughout the machine.

We now proceed to show you how, by experiment, you may find out the laws of efficiency and friction of a real machine with sufficient accuracy for practical purposes.

The construction of the machine itself does not enter directly into the process by which the required results are obtained, hence we shall suppose the machine all hidden from view, as in Fig. 30, there being none of the machine visible except two shafts projecting from the cover, to one of which we apply our force whilst the other raises the load. We must suppose that there is no arrangement inside by which energy can be stored, and that the two shafts are connected in such a way that if one goes round uniformly, the other does the same, though probably at a different speed. The first step is to determine the velocity ratio. Since the dimensions of the different parts of the machine are not known to us, we cannot follow the same method as in the last lesson, but by direct measurement the speed of A can be compared with that of B. Thus, if the smaller weight B falls 5 feet whilst the larger weight A rises 3 inches, the velocity ratio is $\frac{60}{3} = 20$, or 20 to 1.

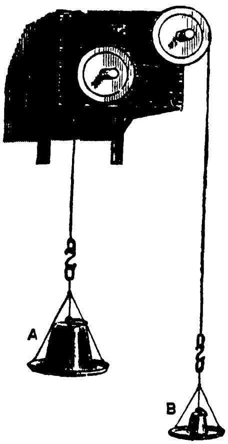

Fig. 30.

If the usual reasoning about mechanical advantage were true, we should find that 1 lb. at B would balance 20 lb. at A. Possibly it may, as it requires a considerable force to set the machine in motion, but if we start B downwards it soon stops.

Adding to the weight B till a steady motion downwards is maintained, we find that more force is required than we supposed. If we add to A, and again find what B must be, a similar result is obtained, the *excess* weight at B increasing as the load is increased.

A series of observations having been made, numbers somewhat like the following are obtained:—

B Force just able to overcome load A and friction.	A. Weight or load overcome.	F. Effect of friction being $B - \frac{A}{20}$.	Efficiency of machine for each load.
12	100	7	·42
21·2	200	11·2	·47
29·8	300	14·8	·50
39	400	19	·513
48·1	500	23·1	·52
56·9	600	26·9	·527
66	700	31	·53
75	800	35	·533

The numbers in the fourth column are obtained from the rule given on page 89, which in this case reduces to

$$\text{Efficiency} = \frac{A}{20 \times B}.$$

Plotting the corresponding pairs of values of A and B as the co-ordinates of points, we obtain the straight line shown in Fig. 31.

In order to see what sort of law connects efficiency and load, the numbers in the second and fourth columns have been plotted in Fig. 32. In order to make the vertical scale of the drawing sufficiently large, the origin is called ·4 on that scale, hence the curve cannot be shown passing through the origin as it would if the zero points of both scales agreed; this would require too large a figure. It will be seen that the law connecting efficiency and load is *not* a simple one, that the efficiency increases with the load more rapidly at first, but later on becomes more nearly constant.

The student will see that the curve is very similar in shape to one or two given as exercises in lesson II. We have in this example taken a case in which the friction is considerable, in order to make the difference between the theoretical and the real result more striking to the beginner. Thus, instead of the constant mechanical advantage 20, we have it varying from 8·3 to 10·6. In many machines, such as the screw-jack, the friction is a much greater fraction of the load, and consequently the efficiency much less than in this instance.

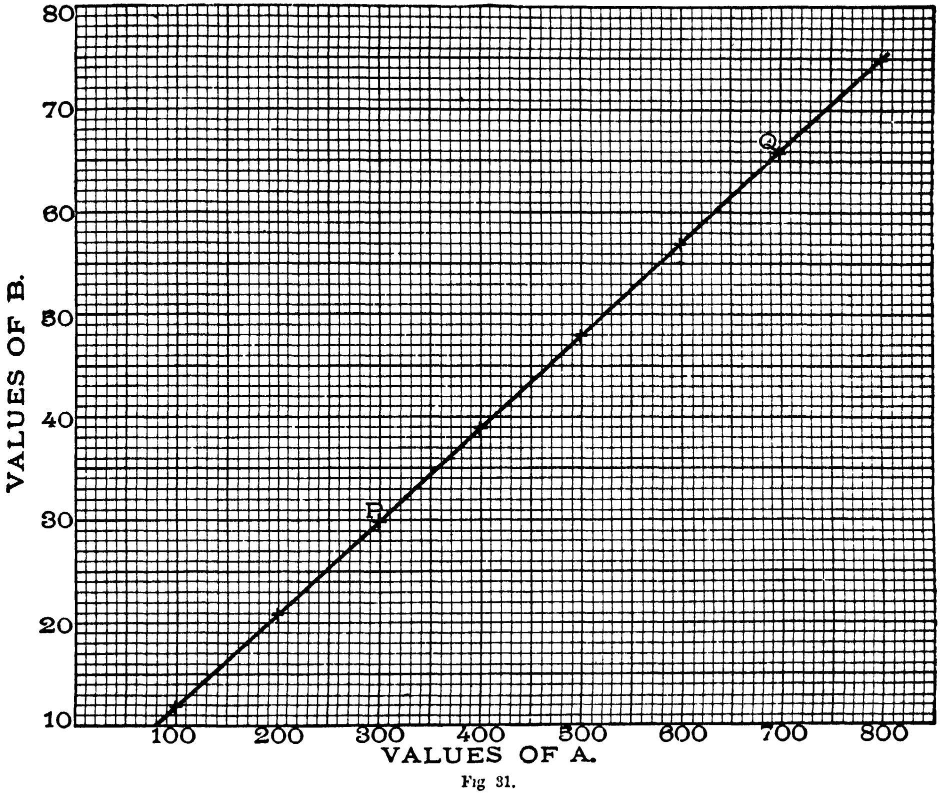

Fig 31.

THE LAW OF THE MACHINE

is easily obtained from the curve in Fig. 31, by the method already indicated; but as the student has now some knowledge of these matters, the following will be found a more convenient way of obtaining the law, especially when, as sometimes happens, the zero point of one or both scales does not lie on the paper.

The general law of our curve (Fig. 31) is of the shape $y = ax + b$, where a and b are constants. In this case it is $B = aA + b$.

To find a and b, take any two points P and Q on the curve. The co-ordinates of these points are

$$B = 30, \ A = 300,$$
$$B = 65, \ A = 690,$$

and putting these values into the general law, we get the two equations

$$30 = a\,300 + b,$$
$$\text{and} \quad 65 = a\,690 + b.$$

Subtracting these we get

$$35 = a\,390,$$
$$\text{or,} \quad a = \cdot 09,$$

and putting this value of a into the first equation, we get

$$b = 3$$

Hence the law of the machine is

$$B = \cdot 09\,A + 3.$$

This law tells us what force is required to lift any given load, and it also tells us that the friction of the machine unloaded is 3.

The student will find it a useful exercise to obtain, in a similar way, the law connecting the effect of friction, F, and load.

A similar method to that explained in this lesson will give the efficiency of any machine, however large, except in the case of machines such as dynamos, where the energy is transformed into another shape; but still the *efficiency* is obtained from the ratio of the work given out to that put in, though different methods may be required for its measurement in the two cases.

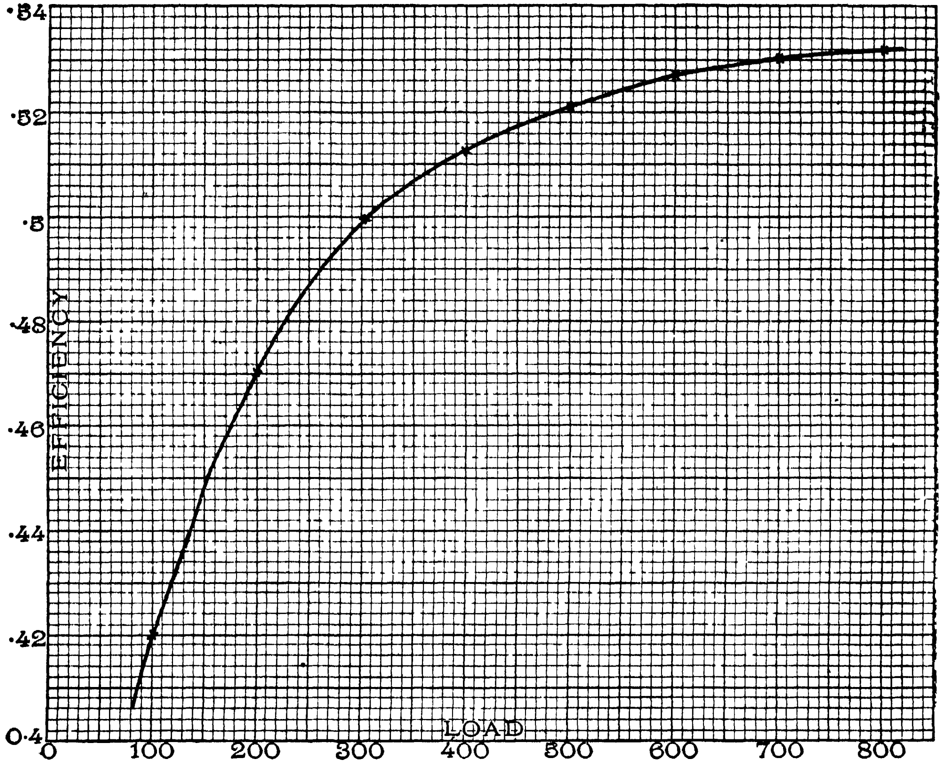

Fig. 32.

If a number of machines work together so that energy is transmitted continuously from one to the other in the same direction, just as in one machine consisting of several parts, then the efficiency of the whole arrangement is the product of the efficiencies of the separate machines or parts.

A good illustration of this is a steam-engine driving a dynamo machine, which in its turn drives one or more electro-motors. Let us tabulate roughly the separate efficiencies in such a case, and then find the combined efficiency of the whole system. Supposing that in a certain interval of time 100 units of energy are given to the boiler-furnace of the engine in the shape of coal, let us write out an account as regards efficiency :—

Energy in the coal supplied to furnace	100	units	Efficiency of boiler	·6
Energy entering cylinder of engine as steam	60	,,	Efficiency of engine	·166
Energy given out by engine	10	,,	Efficiency of shafting	·9
Energy given to dynamo machine . .	9	,,	Efficiency of dynamo	·83
Energy given out by dynamo	7 5	,,	Efficiency of motor and leads . . .	·6
Energy given out by electro-motor . . .	4·5	,,		

$$\text{Total efficiency of system} = \frac{4·5}{100} \text{ or } = ·6 \times ·17 \times ·9 \times ·83 \times ·6$$
$$= ·045, \text{ or } 4\tfrac{1}{2} \text{ per cent.}$$

This is given merely as an illustration of the method of finding the combined efficiency of a system: the numbers are not intended to represent accurately what the efficiency of any particular machine is in actual practice; though some care has been taken to represent, approximately, what really occurs.

A few examples will form a proper conclusion to this lesson.

NUMERICAL EXAMPLES.

1. The velocity ratio of a screw-jack is 326·7 to 1, and its law is $\text{B} = {\cdot}02\text{A} + 9{\cdot}45$; find its efficiency when lifting a load of 1551·6 lb.

As already pointed out,

$$\text{efficiency} = \frac{\text{load A}}{\text{B} \times \text{velocity ratio}}.$$

In this case,

$$= \frac{\text{load A}}{({\cdot}02\text{A} + 9{\cdot}45)326{\cdot}7},$$

$$= \frac{1551{\cdot}6}{({\cdot}02 \times 1551{\cdot}6 + 9{\cdot}45)326{\cdot}7},$$

$$= \frac{1551{\cdot}6}{(31{\cdot}03 + 9{\cdot}45)326{\cdot}7},$$

$$= \frac{1551{\cdot}6}{13224{\cdot}8},$$

= ·117, or a little over 11¾ per cent.

2. The law of a differential pulley-block is $\text{P} = {\cdot}012\text{W} + 6{\cdot}38$; find what load will be lifted by a force of 56 lb.

If the velocity ratio is 90, what is the efficiency of the machine for this load?

Answers, 4,135 lb.; 82 per cent

3. The diameter of the ram of a hydraulic jack is 1¾ inch, the diameter of the pump plunger ⅜ inch, and the mechanical advantage of the handle 10. If the law of the machine, as found by experiment, is $\text{P} = {\cdot}025\text{W} + 5{\cdot}3$, find its efficiency when lifting half a ton. *Answer*, 84 per cent.

ALGEBRA.—XVI.

[*Continued from p.* 161.]

GEOMETRICAL PROPORTION AND PROGRESSION (*continued*).

275. CASE IV.—ADDITION AND SUBTRACTION OF EQUAL RATIOS.

If to or from two analogous or two homologous terms of a proportion, two other quantities having the same ratio be added or subtracted, the proportion will be preserved. **(Euclid V. 2.)**

For a ratio is not altered by adding to it, or subtracting from it, the terms of another *equal* ratio.

If $a : b :: c : d$, and $a : b :: m : n$,

Then, by adding to, or subtracting from, a and b, the terms of the equal ratio $m : n$, we have

$a + m : b + n :: c : d$, and $a - m : b - n :: c : d$.

And by adding and subtracting m and n to and from c and d, we have,

$a : b :: c + m : d + n$, and $a : b :: c - m : d - n$.

Here the addition and subtraction are to and from *analogous* terms. But by alternation these terms will become *homologous*, and we shall have,

$a + m : c :: b + n : d$, and $a - m : c :: b - n : d$.

Cor.—1. This addition may evidently be extended to *any number* of equal ratios. (Euclid V. 2, *Cor.*)

$$\text{Thus, if } a : b :: \left\{ \begin{matrix} c : d \\ h : l \\ m : n \\ x : y \end{matrix} \right\} \text{ then } a : b :: c + h + m + x : d + l + n + y.$$

$$\textit{Cor.}\text{—2. If } \left. \begin{matrix} a : b :: c : d \\ \text{And } m : b :: n : d \end{matrix} \right\} \text{ then } a + m : b :: c + n : d. \text{ (Euclid V. 24).}$$

$$\left. \begin{matrix} \text{For by alternation } a : c :: b : d \\ \text{And } \quad m : n :: b : d \end{matrix} \right\}$$

$$\text{hence} \left\{ \begin{matrix} a + m : c + n :: b : d. \\ \text{or } a + m : b :: c + n : d. \end{matrix} \right.$$

Hence, if two analogous or homologous terms be added to or subtracted from the two others, the proportion will be preserved.

Thus, if $a : b :: c : d$, and $12 \cdot 4 :: 6 . 2$, then,

1. *Adding* the *last* two terms to the *first* two,

$$\begin{array}{ll} a + c : b + d :: a : b & 12 + \quad : 4 + 2 :: 12 : 4 \\ \text{and } a + c : b + d :: c : d & 12 + 6 : 4 + 2 :: 6 : 2 \\ \text{or } a + c : a :: b + d : b & 12 + 6 : 12 :: 4 + 2 : 4 \\ \text{and } a + c : c :: b + d : d & 12 + 6 : 6 :: 4 + 2 : 2 \end{array}$$

2. *Adding* the two *antecedents* to the two *consequents*.

$$\begin{array}{ll} a + b : b :: c + d : d & 12 + 4 : 4 :: 6 + 2 : 2 \\ a + b : a :: c + d : c, \text{ etc.} & 12 + 4 : 12 :: 6 + 2 : 6. \end{array}$$

This is called *composition*. (Euclid V. 18.)

3. *Subtracting* the *first* two terms from the *last* two,

$c - a : a :: d - b : b$, or $c - a : c :: d - b : d$, etc.

4. *Subtracting* the *last* two terms from the *first* two,

$a - c : b - d :: a : b$, or $a - c : b - d :: c : d$, etc.

5. *Subtracting* the *consequents* from the *antecedents*,

$a - b : b :: c - d : d$, or $a : a - b :: c : c - d$, etc.

The alteration expressed by the last of these forms is called *conversion*.

6. *Subtracting* the *antecedents* from the *consequents*,

$b - a : a :: d - c : c$, or $b : b - a :: d : d - c$, etc.

7. Adding and subtracting,

$$a + b : a - b :: c + d : c - d;$$

that is, the sum of the first two terms is to their difference as the sum of the last two to their difference.

Cor.—If any compound quantities, arranged as in the preceding examples, are proportional, the simple quantities of which they are compounded are proportional also.

Thus, if $a + b : b :: c + d : d$, then $a : b :: c : d$. This is called *division*. (Euclid V. 17.)

276. CASE V.—COMPOUNDING PROPORTIONS.

If the corresponding terms of two or more ranks of proportional quantities be multiplied together, the products will be proportional.

This process is called *compounding proportions.* It is the same as *compounding ratios.* It should be distinguished from what is called *composition*, which is an *addition* of the terms of a ratio.

$$\begin{array}{lll}
\text{If} & a : b :: c : d & 12 : 4 :: 6 : 2 \\
\text{And} & h : l :: m : n & 10 : 5 :: 8 : 4 \\
\hline
\text{Then} & ah : bl :: cm : dn & 120 : 20 :: 48 : 8.
\end{array}$$

For, from the nature of proportion, the two ratios in the first rank are equal, and also the ratios in the second rank. And multiplying the corresponding terms is multiplying the *ratios*—that is, multiplying *equals by equals*, so that the ratios will still be equal, and therefore the four products must be proportional.

The same proof is applicable to any number of proportions.

$$\text{If} \left\{\begin{array}{l} a : b :: c : d \\ h : l :: m : n \\ p : q :: x : y \end{array}\right\} \text{then } ahp : blq :: cmx : dny.$$

From this it is evident that if the terms of a proportion be multiplied each into *itself*, that is, if they be *raised to any power*, they will still be proportional.

$$\begin{array}{lll}
\text{If} & a : b :: c : d & 2 : 4 :: 6 : 12 \\
 & a : b :: c : d & 2 : 4 :: 6 : 12 \\
\hline
\text{Then} & a^2 : b^2 :: c^2 : d^2. & 4 : 16 :: 36 : 144.
\end{array}$$

Proportionals will also be obtained by *reversing* this process, that is, by extracting the *roots* of the terms.

If $a : b :: c : d$, then $\sqrt{a} : \sqrt{b} :: \sqrt{c} : \sqrt{d}$.

For taking the products of the extremes and means, $ad = bc$.

And extracting the root of both sides, $\sqrt{ad} = \sqrt{bc}$.

That is, $\sqrt{a} : \sqrt{b} :: \sqrt{c} : \sqrt{d}$.

277. CASE VI.—INVOLUTION AND EVOLUTION OF THE TERMS.

If several quantities are proportional, *their like powers or like roots are proportional.*

If $a : b :: c : d$,

Then $a^n : b^n :: c^n : d^n$, and $\sqrt[m]{a} : \sqrt[m]{b} :: \sqrt[m]{c} : \sqrt[m]{d}$.

And $\sqrt[m]{a^n} : \sqrt[m]{b^n} :: \sqrt[m]{c^n} : \sqrt[m]{d^n}$.

That is, $a^{\frac{n}{m}} : b^{\frac{n}{m}} :: c^{\frac{n}{m}} : d^{\frac{n}{m}}$.

It must not be inferred from this that quantities have the *same ratio* as their like powers or like roots.

If the terms in one rank of proportionals be *divided* by the corresponding terms in another rank, the quotients will be proportional.

This is sometimes called the *resolution* of ratios.

$$\begin{array}{lll}
\text{If} & a : b :: c : d & 12 : 6 :: 18 : 9 \\
\text{And} & h : l :: m : n & 6 : 2 :: 9 : 3 \\
\text{Then} & \frac{a}{h} : \frac{b}{l} :: \frac{c}{m} : \frac{d}{n} & \frac{12}{6} : \frac{6}{2} :: \frac{18}{9} : \frac{9}{3}
\end{array}$$

This is merely *reversing* the process in Case V., and may be demonstrated in a similar manner.

N.B.—This should be distinguished from what geometricians call *division*, which is a *subtraction* of the terms of a ratio.

When proportions are compounded by multiplication, it will often be the case that the *same factor* will be found in two analogous or two homologous terms.

$$\begin{array}{ll}
\text{Thus, if} & a : b :: c : d \\
\text{And} & m : a :: n : c \\
\hline
 & am : ab :: cn : cd.
\end{array}$$

Here a is in the first two terms, and c in the last two. Dividing by these, the proportion becomes

$m : b :: n : d$. Hence,

In compounding proportions, *equal factors* or *divisors* in two analogous or homologous terms may be *rejected.*

$$\begin{array}{lll}
\text{If} \left\{\begin{array}{l} a : b :: c : d \\ b : h :: d : l \\ h : m :: l : n \end{array}\right. & & \begin{array}{l} 12 : 4 :: 9 : 3 \\ 4 : 8 :: 3 : 6 \\ 8 : 20 :: 6 : 15 \end{array} \\
\hline
\text{Then } a : m :: c : n & & 12 : 20 :: 9 : 15
\end{array}$$

This rule may be applied to the cases to which the terms "*ex æquo*" and "*ex æquo perturbata*" refer. One of the methods may serve to verify the other.

When four quantities are proportional, if the *first* be greater than the *second*, the *third* will be greater than the *fourth*; if equal, equal; if less, less.

$$\text{Suppose } a : b :: c : d, \text{ then if} \left\{\begin{array}{l} a = b,\ c = d. \\ a > b,\ c > d. \\ a < b,\ c < d. \end{array}\right.$$

If four quantities are proportional, their *reciprocals* are proportional, and *vice versâ.*

If $a : b :: c : d$, then $\frac{1}{a} : \frac{1}{b} :: \frac{1}{c} : \frac{1}{d}$.

For in each of these proportions, we have, by reduction, $ad = bc$.

PROBLEMS IN GEOMETRICAL PROPORTION.

278. **EXAMPLE.**—Divide the number 49 into two such parts, that the greater increased by 6 may be to the less diminished by 11 as 9 to 2.

Let $x =$ the greater, and $49 - x =$ the less.

By the conditions proposed, $x + 6 : 38 - x :: 9 : 2$.

Adding terms, $x + 6 : 44 :: 9 : 11$.

Dividing the consequents, $x + 6 : 4 :: 9 : 1$.

Multiplying the extremes and means, $\Big\}$ $x + 6 = 36$; and $x = 30$, the greater part, and $49 - x = 49 - 30 = 19$, the lesser part.

EXERCISE 70.

1. What number is that, to which if 3, 8, and 17 be severally added, the first sum shall be to the second as the second to the third?

2. Find two numbers, the greater of which shall be to the less as their sum to 42, and as their difference to 6.

3. Divide the number 18 into two such parts, that the squares of those parts may be in the ratio of 25 to 16.

4. Divide the number 14 into two such parts, that the quotient of the greater divided by the less shall be to the quotient of the less divided by the greater as 16 to 9.

5. If the number 20 be divided into two parts, which are to each other in the *duplicate* ratio of 3 to 1, what number is a mean proportional between those parts?

6. There are two numbers whose product is 24, and the difference of their cubes is to the cube of their difference as 19 to 1. What are the numbers?

7. There are two numbers in the proportion of 5 : 6; the first being increased by 4 and the last by 6, the proportion will be as 4 : 5. What are the numbers?

8. A farmer has a quantity of corn in his granary, and sells a certain number of bushels, which is to the number of bushels remaining as 4 : 5. He then feeds out 10 bushels, which is to the number sold as 1 : 2. How many bushels had he at first, and how many did he sell?

9. There are two numbers whose product is 135, and the difference of their squares is to the square of their difference as 4 to 1. What are the numbers?

10. What two numbers are those, whose difference, sum, and product are as the numbers 2, 3, and 5 respectively?

11. Divide the number 24 into two such parts, that their product shall be to the sum of their squares as 3 to 10.

12. In a mixture of rum and brandy, the difference between the quantities of each is to the quantity of brandy as 100 is to the number of gallons of rum; and the same difference is to the quantity of rum as 4 to the number of gallons of brandy. How many gallons are there of each?

13. There are two numbers which are to each other as 3 to 2; if 6 be added to the greater and subtracted from the less, the sum and remainder will be to each other as 3 to 1. What are the numbers?

14. There are two numbers whose product is 320; and the difference of their cubes is to the cube of their difference as 61 to 1. What are the numbers?

15. There are two numbers, which are to each other in the duplicate ratio of 4 to 3, and 24 is a mean proportional between them. What are the numbers?

CONTINUED GEOMETRICAL PROPORTION OR PROGRESSION.

279. When all the ratios of a series of proportionals are equal, the quantities are said to be in *continued proportion* or *progression*.

As arithmetical proportion continued is arithmetical progression, so geometrical proportion continued is geometrical progression. It is sometimes called progression by quotient.

The numbers 64, 32, 16, 8, 4, are in continued geometrical proportion.

In this series, if each preceding term be *divided* by the common ratio, the quotient will be the following term. Thus,

$$\tfrac{64}{2} = 32, \text{ and } \tfrac{32}{2} = 16, \text{ and } \tfrac{16}{2} = 8, \text{ and } \tfrac{8}{2} = 4.$$

If the order of the series be *inverted*, the proportion will still be preserved, and the common divisor will become a multiplier. In the series 4, 8, 16, 32, 64, etc.,

$$4 \times 2 = 8, \text{ and } 8 \times 2 = 16, \text{ and } 16 \times 2 = 32, \text{ etc.}$$

Quantities then are in geometrical progression when they increase by a common multiplier, or decrease by a common divisor.

This common multiplier or divisor is called the *ratio*. For most purposes, however, it will be more simple to consider the ratio as always a *multiplier*, either integral or fractional.

In the series 64, 32, 16, 8, 4, the ratio is either 2 considered as a divisor, or $\frac{1}{2}$ considered as a multiplier.

When several quantities are in *continued* proportion, the *number of couplets*, and of course the number of *ratios*, is *one less* than the number of quantities. Thus the five proportional quantities, a, b, c, d, e, form four couplets containing four ratios; and the ratio of $a : e$ is equal to the ratio of $a^4 : b^4$, that is, the ratio of the fourth power of the first quantity to the fourth power of the second. Hence,

If *three* quantities are proportional, *the first is to the third as the square of the first to the square of the second, or as the square of the second to the square of the third.* In other words, the first has to the third a *duplicate* ratio of the first to the second. And conversely, if the first of the three quantities is to the third as the square of the first to the square of the second, the three quantities are proportional.

If $a : b :: b : c$, then $a : c :: a^2 : b^2$. And universally,

If *several* quantities are in continued proportion, the ratio of the *first* to the *last* is equal to one of the intervening ratios raised to a power whose index is one less than the number of quantities.

If there are *four* proportionals, a, b, c, d, then $a : d :: a^3 : b^3$.

If there are *five*, a, b, c, d, e; $a : e :: a^4 : b^4$, etc.

If several quantities are in continued proportion, they will be proportional when the order of the whole is *inverted*. This has already been proved with respect to *four* proportional quantities. It may be extended to any number of quantities.

Between the numbers,	64, 32, 16, 8, 4,
The ratios are,	2, 2, 2, 2.
Between the same inverted,	4, 8, 16, 32, 64,
The ratios are,	$\frac{1}{2}, \frac{1}{2}, \frac{1}{2}, \frac{1}{2}$.

So if the order of any proportional quantities be inverted, *the ratios in one series will be the reciprocals of those in the other. For by the inversion* each antecedent becomes a consequent, and *vice versâ;* but the ratio of a consequent to its antecedent is the reciprocal of the ratio of the antecedent to the consequent. That the reciprocals of equal quantities are themselves equal is evident from Ax. 4.

280. To investigate the properties of geometrical progression, we may take nearly the same course as in arithmetical progression; observing to substitute continual *multiplication and division*, instead of addition and subtraction. It is evident, in the first place, that,

In an *ascending* geometrical series, each succeeding term is found by *multiplying the ratio* into the preceding term.

If the first term is a, and the ratio r,

Then $a \times r = ar$, the second term; $ar \times r = ar^2$, the third; $ar^2 \times r = ar^3$, the fourth; $ar^3 \times r = ar^4$, the fifth, etc.

And the series is a, ar, ar^2, ar^3, ar^4, ar^5, etc.

If the *first term* and the *ratio* are the *same*, the progression is simply a series of powers.

If the first term and ratio are each equal to r,

Then $r \times r = r^2$, the second term; $r^2 \times r = r^3$, the third; $r^3 \times r = r^4$, the fourth; $r^4 \times r = r^5$, the fifth.

And the series is r, r^2, r^3, r^4, r^5, r^6, etc.

In a *descending* series, each succeeding term is found by *dividing* the preceding term by the ratio, or *multiplying* by the fractional ratio.

If the first term is ar^6, and the ratio r,

$$\text{The second term is } \frac{ar^6}{r}, \text{ or } ar^6 \times \frac{1}{r} = ar^5.$$

And the series is ar^6, ar^5, ar^4, ar^3, ar^2, ar, a, etc.

If the first term is a, and the ratio r,

The series is $a, \frac{a}{r}, \frac{a}{r^2}, \frac{a}{r^3}$, etc., or a, ar^{-1}, ar^{-2}, etc.

1st. 2nd. 3rd. 4th. 5th 6th.

By attending to the series, a, ar, ar^2, ar^3, ar^4, ar^5, etc., it will be seen that, in each term, the exponent of the power of the ratio is *one less* than the number of the term.

If then

$a =$ the first term, $r =$ the ratio,

$z =$ the last, $n =$ the number of terms,

we have the equation $z = ar^{n-1}$, the last term; that is,

In geometrical progression, *the last term is equal to the product of the first into that power of the ratio whose index is one less than the number of terms.*

When the first term and the ratio are the *same*, the equation becomes $z = rr^{n-1} = r$.

Of the four quantities, a, z, r, and n, any *three* being given, the other may be found.

1. By the last article,

$$z = ar^{n-1} = \text{the } \textit{last term}.$$

2. *Dividing by* r^{n-1},

$$\frac{z}{r^{n-1}} = a = \text{the } \textit{first term}.$$

3. Dividing the 1st by a, and extracting the root,

$$\left(\frac{z}{a}\right)^{\frac{1}{n-1}} = r = \text{the } \textit{ratio}.$$

By the last equation may be found any number of *geometrical means* between two given numbers. If $m =$ the number of means, $m + 2 = n$, the *whole* number of terms. Substituting $m + 2$ for n in the equation, we have,

$$\left(\frac{z}{a}\right)^{\frac{1}{m+1}} = r, \text{ the } \textit{ratio}.$$

When the ratio is found, the means are obtained by continued multiplication.

281. The next thing to be attended to is the rule for finding the *sum of all the terms.*

If any term, in a geometrical series, be multiplied by the ratio, the product will be the succeeding term. Of course, if *each* of the terms be multiplied by the ratio, a new series will be produced, in which all the terms except the last will be the same as all except the first in the other series. To make this plain, let the new series be written under the other, in such a manner that each term shall be removed one step to the right of that from which it is produced in the line above.

Take, for example, the series, 2, 4, 8, 16, 32.
Multiplying each term by the ratio, 4, 8, 16, 32, 64.

Here it will be seen at once that the last four terms in the upper line are the same as the first four in the lower line. The only terms which are not in *both*, are the *first* of the one series, and the *last* of the other. So that when we subtract the one series from the other, all the terms except these two will disappear, by balancing each other.

If the given series is, $a, ar, ar^2, ar^3, \ldots ar^{n-1}$.
Then mult. by r, we have $ar, ar^2, ar^3, \ldots ar^{n-1}, ar^n$.

Now let $s =$ the sum of the terms.

Then, $s = a + ar + ar^2 + ar^3, \ldots + ar^{n-1}$.
And multiplying by r,

$$\underline{rs = \quad ar + ar^2 + ar^3, \ldots + ar^{n-1} + ar^n.}$$

Subtracting the first equation from the second,

$$rs - s = ar - a.$$

And dividing by $(r - 1)$, $s = \frac{ar^n - a}{r - 1}$.

In this equation, ar^n is the last term in the new series, and is therefore the product of the ratio into the last term in the *given series.*

Therefore, $s = \frac{rz - a}{r - 1}$, that is,

1. Find two geometrical means between 4 and 256.

2. Find three geometrical means between $\frac{1}{9}$ and 9.

3. If the first term of a decreasing geometrical series is $\frac{1}{2}$, the ratio $\frac{1}{3}$, and the number of terms 5, what is the sum of the series?

4. What is the sum of the series 1, 3, 9, 27, etc., to 7 terms?

5. What is the sum of ten terms of the series 1, $\frac{2}{3}$, $\frac{4}{9}$, $\frac{8}{27}$, etc ?

6. If the first term of a series is 2, the ratio 2, and the number of terms 13, what is the last term?

7. What is the 12th term of a series, the first term of which is 3, and the ratio 3? Also find the sum of the series.

8 A man bought a horse, agreeing to give one farthing for the first nail in his shoes, three for the second, and so on The shoes contained 32 nails; what was the cost of the horse?

282. *Quantities in geometrical progression are proportional to their differences.*

Let the series be a, ar, ar^2, ar^3, ar^4, etc.

By the nature of geometrical progression,

$$a : ar :: ar : ar^2 :: ar^2 . ar^3 :: ar^3 : ar^4, \text{ etc.}$$

In each couplet let the antecedent be subtracted from the consequent.

Then $a : ar :: ar - a : ar^2 - ar :: ar^2 - ar : ar^3 - ar^2$, etc.

That is, the first term is to the second, as the difference between the first and the second to the difference between the second and third; and as the difference between the second and third to the difference between the third and fourth, etc.

If quantities are in geometrical progression, their *differences* are also in geometrical progression.

Thus the numbers 3, 9, 27, 81, 243, etc.,

And their differences 6, 18, 54, 162, etc.,

are in geometrical progression.

Problems in geometrical progression may be solved, as in other parts of algebra, by means of equations.

Example.—Find three numbers in geometrical progression, such that their sum shall be 14, and the sum of their squares 84.

Let the three numbers be x, y, and z.

By the conditions, $x : y :: y : z$, or $xz = y^2$

And $x + y + z = 14$.

And $x^2 + y^2 + z^2 = 84$.

From these three equations, x, y, and $z = 2, 4$, and 8. ***Ans.***

5. There are three numbers in geometrical progression, the greatest of which exceeds the least by 15; and the difference of the squares of the greatest and the least is to the sum of the squares of all the three numbers as 5 to 7. What are the numbers?

6. There are four numbers in geometrical progression, the second of which is less than the fourth by 24; and the sum of the extremes is to the sum of the means as 7 to 3. What are the numbers?

KEY TO EXERCISES.

Exercise 68.

1. 440.
2. 10100 yards, or 5 miles 1300 yds.
3. 3775.
4. 3.
5. 21.
6. 280.
7. £1104 10s.
8. £3339 15s.
9. 156.
10. 300.
11. 10000 and n^2.
12. 730 and $2n$.
13. 301 and $3n + 1$.
14. Interest, £2 8s.; amount, £3 8s.
15. 8.
16. 19.
17. 6, 13, 20, 27, 34, 41 and 48.
18. 8, 12, 16, 20, 24, 28, 32 and 36.

Exercise 69.

1. 1, 3 and 5.
2. 3, 5 and 7.
3. ± 14, ± 10, ± 6 and 2.
4. 3, 5, 7 and 9.
5. 1, 5, 9 and 13.

ITALIAN.—IV.

[*Continued from p.* 165.]

THE ARTICLE (*continued*).

I.—NOUNS DECLINED WITH AND WITHOUT AN ARTICLE.

Singular.

Nom.		*li-bro*	*il li-bro*, the book.
Gen.	*di*	*li-bro*	*del li-bro*, of the book.
Dat.	*a*	*li-bro*	*al li-bro*, to the book.
Acc.		*li-bro*	*il li-bro*, the book.
Abl.	*da*	*li-bro*	*dal li-bro*, from the book.
	in	*li-bro*	*nel li-bro*, in the book.
	con	*li-bro*	*col li-bro*, with the book.
	per	*li-bro*	*pel li-bro*, for the book.
	su	*li-bro*	*sul li-bro*, on the book.

Plural.

Nom.		*li-bri*	*i li-bri*, the books.
Gen.	*di*	*li-bri*	*dei* (*de'*) *li-bri*,* of the books
Dat.	*a*	*li-bri*	*ai* (*a'*) *li-bri*, to the books.
Acc.		*li-bri*	*i li-bri*, the books.
Abl.	*da*	*li-bri*	*dai* (*da'*) *li-bri*, from the books.
	in	*li-bri*	*nei* (*ne'*) *li-bri*, in the books.
	con	*li-bri*	*coi* (*co'*) *li-bri*, with the books.
	per	*li-bri*	*pei* (*pe'*) *li-bri*, for the books.
	su	*li-bri*	*sui* (*su'*) *li-bri*, on the books.

* The plurals *dei, ai, dai, nei, coi, pei, sui*, are frequently marked with the apostrophe for the sake of harmony, thus: *de', a', da', ne', co', pe', su'*; especially when coming before several words all of which terminate in *i*. For example, *a ca-gió-ne de' mól-ti suó-i pec-cá-ti*, on account of his many sins.

Singular.

Nom.		*schióp-po*	*lo schióp-po*, the gun.
Gen.	*di*	*schióp-po*	*dél-lo schiop-po*, of the gun.
Dat.	*a*	*schióp-po*	*ál-lo schióp-po*, to the gun.
Acc.		*schióp-po*	*lo schióp-po*, the gun.
Abl.	*da*	*schióp-po*	*dál-lo schióp-po*, from the gun.
	in	*schióp-po*	*nél-lo schióp-po*, in the gun.
	con	*schióp-po*	*cól-lo schióp-po*, with the gun.
	per	*schióp-po*	*per lo schióp-po*, for the gun.
	su	*schióp-po*	*súl-lo schióp-po*, on the gun.

Plural.

Nom.		*schióp-pi*	*gli schióp-pi*, the guns.
Gen.	*di*	*schióp-pi*	*dé-gli schióp-pi*, of the guns.
Dat.	*a*	*schióp-pi*	*á-gli schióp-pi*, to the guns.
Acc.		*schióp-pi*	*gli schióp-pi*, the guns.
Abl.	*da*	*schióp-pi*	*dá-gli schióp-pi*, from the guns.
	in	*schióp-pi*	*né-gli schióp-pi*, in the guns.
	con	*schióp-pi*	*có-gli schióp-pi*, with the guns.
	per	*schióp-pi*	*pé-gli schióp-pi*, for the guns.
	su	*schióp-pi*	*sú-gli schiop-pi*, on the guns.

Singular.

Nom.		*Lón-dra*, London.	Nom.		*Al-bér-to*, Albert.
Gen.	*di*	*Lón-dra*, of London.	Gen.	*di*	*Al-bér-to*, of Albert.
Dat.	*a*	*Lón-dra*, to London.	Dat.	*ad*†	*Al-bér-to*, to Albert.
Acc.		*Lón-dra*, London.	Acc.		*Al-bér-to*, Albert.
Abl.	*da*	*Lón-dra*, from London.	Abl.	*da*	*Al-bér-to*, from Albert.
	in	*Lón-dra*, in London.		*in*	*Al-bér-to*, in Albert.
	con	*Lón-dra*, with London.		*con*	*Al-bér-to*, with Albert.
	per	*Lón-dra*, for London.		*per*	*Al-bér-to*, for Albert.

Singular.

Nom.		*Di-o*, God.	Abl.	*da*	*Di-o*, from God.
Gen.	*di*	*Di-o*, of God.		*in*	*Di-o*, in God.
Dat.	*a*	*Di-o*, to God.		*con*	*Di-o*, with God.
Acc.		*Di-o*, God.		*per*	*Di-o*, for God.

It is obvious that proper names of gods, persons, towns, and other localities, require no article in the singular.

There are, besides the article, many other words (numerals, pronouns, and adjectives) pointing out with more or less precision the definite character of a noun, and generally connected with it. The declension of these words likewise requires that only the three case-signs *di*, *a*, and *da*, should be placed before them. We shall also lay down here, as a general rule in Italian, that any numeral, pronoun, or adjective which points out the definite character of a noun with a sufficient or with a still greater precision than the article itself, renders the latter superfluous, and such words are, on the other hand, always accompanied by the article when they do not precisely determine the noun before which they are placed.

II.—NOUNS DECLINED WITH SOME IMPORTANT WORD PRECEDING THEM.

Singular.

Un fió-re, a flower.	*Ú-no scú-do*, a shield.
D' un fió-re, of a flower.	*D' ú-no scú-do*, of a shield.
Ad un fió-re, to a flower.	*Ad ú-no scú-do*, to a shield.
Un fió-re, a flower.	*Ú-no scú-do*, a shield.
Da un fió-re, from a flower.	*Da ú-no scú-do*, from a shield.
In un fió-re, in a flower.	*In ú-no scú-do*, in a shield.
Con un fió-re, with a flower.	*Con ú-no scú-do*, with a shield.
Per un fio-re, for a flower.	*Per ú-no scú-do*, for a shield.

Plural.

Al-cú-ni fió-ri, some flowers.	*Al-cú-ni scú-di*, some shields.
D' al-cu-ni fio-ri, of some flowers.	*D' al-cú-ni scú-di*, of some shields.
Ad al-cú-ni fió-ri, to some flowers.	*Ad al-cú-ni scú-di*, to some shields.
Al-cú-ni fió-ri, some flowers.	*Al-cú-ni scú-di*, some shields.
Da al-cú-ni fio-ri, from some flowers.	*Da al-cú-ni scu-di*, from some shields.
In al-cú-ni fió-ri, in some flowers.	*In al-cu-ni scú-di*, in some shields.
Con al-cú-ni fió-ri, with some flowers.	*Con al-cú-ni scú-di*, with some shields.
Per al-cu-ni fió-ri, for some flowers.	*Per al-cu-ni scú-di*, for some shields.

The word *un* or *ú-no* for the masculine, and *ú-na* for the feminine, is considered by many grammarians to be the indefinite article corresponding to *a* or *an* in English. It is a word expressing indefinite unity: for example, *un lí-bro*, a book, and *ú-na cá-sa*, a house, express the general idea of any book and any house. It is, moreover, a word expressing definite unity, that is, a numeral: for example, *un uô-mo e cín-que dôn-ne*, one man and five women; *ú-na líb-bra e tre ón-ce*, one pound and three ounces. It is also frequently a pronoun, having the definite articles *lo* and *la* before it signifying *the one* (masculine and feminine): for example, *l' ú-no dí-ce di sì, l' ál-tro di nô*, the one says yes, the other no; *l' ú-na è bél-la, l' ál-tra è brút-ta*, the one (woman) is pretty, the other is ugly.

Before a consonant which is not the *s* impure, and before the masculine nouns beginning with a vowel one uses *un*: as *un lí-bro, un ca-vál-lo, un in-gé-gno, un uó-mo.* The feminine, *ú-na*, generally loses the *a*, and an apostrophe must be substituted, before nouns commencing with a vowel. The words *al-cú-ni*, some, pl. (for the masculine), and *al-cú-ne*, some, pl. (for the feminine), may be considered as substitutes for the plural of *ú-no* and *ú-na*. *Al-cú-ni* and *al-cú-ne* are, strictly speaking, the plurals of the pronouns *al-cú-no* (masc.), and *al-cú-na* (fem.), somebody.

Singular.	*Plural.*
Un a-mi-co, a friend.	*Al-cú-ni a-mi-ci*, some friends.
D' un a-mi-co, of a friend.	*D' al-cú-ni a-mi-ci*, of some friends.
Ad un a-mí-co, to a friend.	*Ad al-cú-ni a-mi-ci*, to some friends.
Un a-mí-co, a friend.	*Al-cú-ni a-mi-ci*, some friends.
Da un a-mi-co, from a friend.	*Da al-cú-ni a-mi-ci*, from some friends.
In un a-mi-co, in a friend.	*In al-cu-ni a-mi-ci*, in some friends.
Con un a-mi-co, with a friend.	*Con al-cú-ni a-mi-ci*, with some friends.
Per un a-mi-co, for a friend.	*Per al-cú-ni a-mi-ci*, for some friends.

Singular.

Ú-na gal-li-na, a hen.	*Un' ó-ca*, a goose.
D' u-na gal-li-na, of a hen.	*D' un' ó-ca*, of a goose.
Ad ú-na gal-li-na, to a hen.	*Ad un' ó-ca*, to a goose.
Ú-na gal-li-na, a hen.	*Un' ó-ca*, a goose.

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† Harmony frequently requires that to the case-sign *a*, when it comes before a vowel, the letter *d* should be added; as, *ad o-nó-re*, to honour; *ad a-mi-co*, to (the) friend; for *a onore*, and *a amico*.

The case-sign *da* is never marked with the apostrophe, but always written in full, in order to avoid the inevitable ambiguity of confounding the case-sign *di* with it whenever it is marked with the apostrophe.

Da ú-na gal-lí-na, from a hen.	*Da un' ó-ca*, from a goose.
In ú-na gal-lí-na, in a hen.	*In un' ó-ca*, in a goose.
Con ú-na gal-lí-na, with a hen.	*Con un' ó-ca*, with a goose.
Per ú-na gal-lí-na, for a hen.	*Per un' ó-ca*, for a goose.

Plural.

Al-cú-ne gal-lí-ne, some hens.	*Al-cú-ne ó-che*, some geese.
D' al-cú-ne gal-lí-ne, of some hens.	*D' al-cu-ne ó-che*, of some geese.
Ad al-cú-ne gal-lí-ne, to some hens.	*Ad al-cú-ne ó-che*, to some geese.
Al-cú-ne gal-lí-ne, some hens.	*Al-cú-ne ó-che*, some geese.
Da al-cú-ne gal-lí-ne, from some hens.	*Da al-cu-ne ó-che*, from some geese.
In al-cú-ne gal-lí-ne, in some hens.	*In al-cú-ne ó-che*, in some geese.
Con al-cú-ne gal-lí-ne, with some hens.	*Con al-cú-ne ó-che*, with some geese
Per al-cú-ne gal-lí-ne, for some hens.	*Per al-cú-ne ó-che*, for some geese.

Singular.	*Plural.*
Tút-to il pó-po-lo, all the nation.	*Tút-ti i pó-po-li*, all nations.
Di tút-to il pó-po-lo, of all the nation.	*Di tút-ti i pó-po-li*, of all nations
A tút-to il pó-po-lo, to all the nation, etc.	*A tút-ti i pó-po-li*, to all nations, etc.

The words *tút-to* (masc.), *tút-ta* (fem.), all, entire, whole, and *am-be-dúe*, both, have this peculiarity, that the article is placed after them whenever they come before a noun; as, *tút-to il món-do*, all the world; *am-be-dúe i fra-têl-li*, both the brothers. *Am-be-dúe* is used for the masculine as well as for the feminine, and naturally has no singular. The singular *tút-to* and *tút-ta* signifies the whole of, ALL THE; the plural *tút-ti* and *tút-te* merely signifies ALL.

Singular.

Quel giar-dí-no, that garden.	*Quest' uc-cêl-lo*, this bird.
Di quel giar-dí-no, of that garden.	*Di quest' uc-cêl-lo*, of this bird.
A quel giar-dí-no, to that garden.	*A quest' uc-cêl-lo*, to this bird.
Quel giar-dí-no, that garden, etc.	*Quest' uc-cêl-lo*, this bird, etc.

Plural.

*Quei** *giar-dí-ni*, those gardens.	*Que-sti uc-cêl-li*, these birds.
Di quei giar-dí-ni, of those gardens.	*Di que-sti uc-cêl-li*, of these birds.
A quei giar-dí-ni, to those gardens.	*A que-sti uc-cêl-li*, to these birds.
Quei giar-dí-ni, those gardens, etc.	*Qué-sti uc-cêl-li*, these birds, etc.

Before words commencing with the *s* impure, *quél-lo* is used. Before words commencing with vowels, the *final o's* and *a's* of *quél-lo*, *quél-la*, and *qué-sto*, *qué-sta*, are generally not pronounced, and in writing an apostrophe is placed instead.

Singular.	*Plural.*
O-gni † *sol-dá-to*, each soldier.	*Cin-que sol-dá-ti*, five soldiers.
D' ó-gni sol-da-to, of each soldier.	*Di cin-que sol-da-ti*, of five soldiers.
Ad ó-gni sol-dá-to, to each soldier.	*A cin-que sol-dá-ti*, to five soldiers.
O-gni sol-dá-to, each soldier, etc.	*Cin-que sol-da-ti*, five soldiers, etc.

VOCABULARY.*

Panno, cloth.
Coltello, knife.
Tondo, plate.
Sale, salt.
Cibo, article of food, aliment.
Cortile, court-yard.
Cuoco, cook. (The plural of this noun requires the auxiliary letter *h* between c and *i*, in order to preserve the sound of c like *k*.)
Sogno, dream.
Teatro, theatre.
Ruscello, brook.
Polmone, lung.
Danaro, money.
Fazzoletto, pocket-handkerchief.
Cappello, hat.
Piacere, pleasure.
Mantello, cloak.
Giovane, young man, youth.
Ponte, bridge.
Quadro, picture.
Terra, earth.
Staffiere, footman.
Sposo, bridegroom.
Straniere, stranger.
Stramazzo, a quilted mattress.
Spiede, *spiedo*, spit, broach.
Smeraldo, emerald.
Scrittore, author, writer.
Stampatore, printer.
Stato, state, condition. (After the four particles *con*, *in*, *non*, and *per*, and, generally speaking, after every word ending with a consonant, the vowel *i* is, for the sake of harmony, prefixed to any word commencing with the *s* impure, unless it be a proper noun: thus, *Ste-fa-no*, *Sci-pio-ne*; for it is not allowable to say *con Istefano*, *con Iscipione*, etc.)
Specchio, looking-glass.
Stivale, boot.
Studio, study.
Spirito, spirit.
Scultore, sculptor.
Strumento, instrument, tool.
Spaccalegna, wood-cleaver.
Spadaio, sword-cutler.
Scoglio, rock.
Scanno, bench.
Occhio, eye.
Uccello, bird.
Amico, friend.
Osso, bone.
Errore, error, fault.
Incisore, engraver.
Ingrato, ungrateful.
Albero, tree.
Onore, honour.
Anno, year.
Orecchio (pl. *orecchj*), ear.
Amore, love.
Abito, dress, coat.
Iniquo, wicked.
Inganno, deceit.
Operaio, day-labourer.
Adulatore, flatterer.
Edifizio, building, edifice.
Infelice, unhappy.

EXERCISE 1.

Translate into English:—

1. Il pán-no. 2. Del col-têl-lo. 3. Al tón-do. 4. Dal sá-le. 5. I ci-bi. 6. Dei cor-tí-li. 7. Ai cuô-chi. 8. Dai só-gni. 9. In teá-tro. 10. Nel ru-scêl-lo. 11. Nei pol-mó-ni. 12. Con da-ná-ro. 13. Col faz-zo-lét-to. 14. Coi cap-pêl-li. 15. Per pia-cé-re. 16. Pel man-têl-lo. 17. Pei gió-va-ni. 18. Sul pón-te. 19. Sui quá-dri. 20. Su qué-sta têr-ra. 21. Lo staf-fiê-re. 22. Dél-lo spô-so. 23. Al-lo stra-niê-re. 24. Dé-gli sme-rál-di. 25. A-gli scrit-tó-ri. 26. Dá-gli stam-pa-tó-ri. 27. Nél-lo spêc-chio. 28. Né-gli sti-vá-li. 29. Con i-stú-dio. 30. Cól-lo spí-ri-to. 31. Có-gli scul-tó-ri. 32. Per lo spac-ca-lé-gna. 33. Per lo spa-dá-io. 34. Súl-lo scô-glio. 35. Sú-gli scán-ni. 36. L'ôc-chio. 37. Dell'uc-cêl-lo. 38. All'a-mi-co. 39. Gli er-ró-ri. 40. Dégl'in-ci-só-ri. 41. Agl'in-grá-ti. 42. Dá-gli ál-be-ri. 43. Nell'án-no. 44. Con a-mó-re. 45. Coll'á-bi-to. 46. Cógl'i-ni-qui. 47. Per in-gán-no. 48. Per l'o-pe-rá-io. 49. Per gli a-du-la-tó-ri. 50. Sull'e-di-fí-zio. 51. Sugl'in-fe-lí-ci.

The pupil should read these exercises aloud.

VOCABULARY.

Il pá-dre, the father.
La má-dre, the mother.
Il fra-têl-lo, the brother.
La so-rêl-la, the sister.
Buô-no (m.), *buô-na* (f.), good.
E (sometimes *ed* before a vowel), and;
è, is. [my.
Mí-o, *il mí-o* (m.), *Mí-a*, *la mia* (f.), my.
U-no (m.), *ú-na* (f.), a, an. [thy.
Tú-o (m.), *tú-a* (f.),
Ha, has.
An-che, also, likewise, too.
Il li-bro, the book.

EXERCISE 2 (COLLOQUIAL).

Translate into English:—

1. Il pá-dre e la má-dre. 2. Il fra-têl-lo e la so-rêl-la. 3. Il pá-dre è buô-no, la má-dre è buô-na.

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* The masculine plural *quei* (also pronounced *quéi*) or *que'*, is a contraction of *quél-li*. Before vowels, or the *s* impure, *qué-gli* is used in the place of the plurals *quél-li*, *quei*, or *que'*. The feminine plurals *quél-le* and *qué-ste* cannot be marked with the apostrophe, but must always be pronounced and written in full.

† *O-gni* has no plural number, and can only be used before nouns.

* The Vocabularies, which contain other words than those used in the Exercises, should always be learnt by heart.

4. Il buôn pá-dre, la buô-na má-dre. 5. Il fra-têl-lo è buô-no, la so-rêl-la è buô-na. 6. Il buôn fra-têl-lo, la buô-na so-rêl-la. 7. Mí-o pá-dre; il mí-o buôn pá-dre. 8. Mí-a má-dre; la mí-a buô-na má-dre. 9. Mí-o pá-dre è buô-no, mí-a má-dre è buô-na. 10. Mí-o fra-têl-lo e mí-a so-rêl-la. 11. Il mí-o buôn fra-têl-lo e la mí-a buô-na so-rêl-la. 12. Un pá-dre, ú-na má-dre, un fra-têl-lo, ú-na so-rêl-la. 13. Un buôn pá-dre, ú-na buô-na mádre, un buôn fra-têl-lo, ú-na buô-na so-rêl-la. 14. Mí-o pá-dre è un buôn pád-re, mía má-dre è ú-na buô-na mádre. 15. Tú-o pá-dre ha ú-na buô-na so-rêl-la, tú-a má-dre ha un buôn fra-têl-lo.

THE PREPOSITION *DI*—ITS USE, ETC.

The use of this word very frequently coincides with the use of the case-sign, or preposition *of*, in English grammar:—

1. When the questions *of whom? of which? of what? whose? what kind* or *sort of?* require the genitive also in English: for example, *L'a-mó-re del pádre*, the love of the father.

2. When geographical or other proper names indicating possession, domain, authorship, etc., or merely for the purpose of defining them, are joined to other nouns: for example, *la cit-tà di Ve-né-zia*, the city of Venice; *il ré-gno di Spá-gna*, the kingdom of Spain; *il mé-se di Lú-glio*, the month of July; *il nó-me di Fran-cé-sco*, the name of Francis; *le tra-gê-die di Al-fiê-ri*, the tragedies of Alfieri; *le com-mê-die di Gol-dó-ni*, the comedies of Goldoni.

3. When words expressing quantity, weight, or any kind of measure, are joined to other nouns: for example, *ú-na quan-ti-tà di pé-co-re*, a quantity of sheep; *ú-na líb-bra di cár-ne*, a pound of meat; *ví-no di diê-ci án-ni*, wine of ten years.

For the sake of elegance, the preposition *di* is, however, sometimes omitted after the words *cá-sa*, house; *pal-láz-zo*, palace; *piáz-za*, place, square; *víl-la*, villa; *gal-le-rí-a*, gallery; *fa-mí-glia*, family; *pôr-ta*, gate, entry, and some others, when they are followed by the name of the owner or the person after whom they are called: for example: *in cá-sa Al-tiè-ri*, at the Altieri-house; *vi-cí-no al pa-láz-zo Bor-ghé-se*, near the Borghese-palace, etc.

English compound nouns, or combinations of nouns, for the greatest part must be decomposed by the genitive case with the case-sign *di*, especially when one of the nouns merely defines and qualifies the other, which is the principal word conveying the principal idea: for example, garden door, *pôr-ta di giar-di-no* (door of the garden); stone-quarry, *cá-va di piê-tra* (quarry of stone); autumn fruits, *frút-ti d'au-tún-no;* a music amateur, *un di-let-tán-te di mú-si-ca*.

English adjectives, indicating the material or stuff from which anything is manufactured, or denoting qualities or derived from proper names of countries, nations, or towns, for the greatest part will be translated into Italian by means of nouns in the genitive case: for example, a gold watch, *ún o-ro-ló-gio d'ó-ro* (a watch of gold); a marble statue, *ú-na stá-tua di már-mo.*

Whenever the infinitive mood of any verb explains and defines another word, the preposition *di* must be placed before it (just as the preposition *of* with the present participle of English grammar in such cases): for example, *Ha ú-na gran vô-glia di viag-giá-re*, he has a great desire to travel *or* of travelling.

The word *di* is sometimes a mere expletive: for example, *é-gli dí-ce di sì, ed í-o dí-co di nô*, he says yes, and I say no.

Di, among all the prepositions of the Italian language, is of by far the most extensive use. The reason of this is that *di*, properly and philosophically speaking, merely expresses the mental separation of *ideas* or notions.

We have thought it useful, in some cases, to denote the pronunciation of the *z* or *zz*. We have done so by placing after such words in parenthesis *ts*, thus (*ts*), when the pronunciation of the *z* or *zz* is to be the sharp hissing one; and *ds*, thus (*ds*), when the pronunciation of the *z* or *zz* is to be the soft one.

VOCABULARY.

Abyss, *a-bis-so*, m.
Action, *a-zió-ne*, f.
Air, *a-ria*, f.
And, *e.*
And not, *e non.*
Are, *so-no.*
Aunt, *zí-a* (*ts*), f.
Beauty, *bel-lez-za* (*ts*), f.
Behaviour, *con-dót-ta*, f.
Belong, *ap-par-tén-go-no.*
Belongs, *ap-par-tiê-ne.*
Body, *cór-po*, m
Brother, *fra-têl-lo*, m.
Child, *fan-ciúl-lo*, m.
Colour, *co-ló-re*, m.
Commerce, *com-mêr-cio*, m.
Countenance, *fi-so-no-mí-a*, f.
Courage, *co-rág-gio*, m.
Cousin, *cu-gí-na*, f.
[illegible]ess, *o-scu-ri-tà*, f.
Dawn, *spun-tár*, m.
Day, *giór-no*, m.
Disorder, *dis-or di-ne*, m.
Dress, *á-bi-to*, m.
Error, *er-ró-re*, m.
Exercise, *mô-to*, m.
Father, *pá-dre*, m.
Fault, *er-ró-re*, m.
Fertility, *fer-ti-li-tà*, f.
Field, *cám-po*, m.
Garden, *giar-di-no*, m.
Glory, *glô-ria*, f.
Happiness, *fe-li-ci-tà*, f.
Here are, *éc-co.*
Highest degree, *cól-mo*, m.
Interest, *in-ter-ês-se*, m.
Is, *è.*
Is not here, *non è qui.*
Is useful, *gió-va.*
Language, *lin-gua*, f.
Leads, *con-dú-ce.*
Legislator, *le-gi-sla-tó-re*, m.
Life, *vi-ta*, f.
Man, *uô-mo*, m.; pl. *gli uô-mi-ni.*
Master, *pa-dró-ne*, m.
Mind, *á-ni-ma*, f.; *spi-ri-to*, m.
Mirror, *spêc-chio*, m.
Money, *da-ná-ro*, m.
Must always obey, *dê-vo-no sém-pre ob-be-di-re.*
Night, *nôt-te*, f.
Ornament, *or-na-men-to*, m.
Palace, *pa-láz-zo* (*ts*), m.
Parents, *ge-ni-tó-ri*, pl.
Perfection, *per-fe-zió-ne*, f.
Physician, *mé-di-co*, m.
Pleasure, *pia-cé-re*, m.
Practice, *es-er-ci-zio*, m.
Prince, *prin-ci-pe*, m.
Rainbow, *ar-co-ba-lé-no*, m.
Return, *ri-tór-no*, m.
Rising, *le-var*, m.
Room, *cá-me-ra*, f.
Says, *di-ce.*
Sense, *sén-so*, m.
Shortens, *ac-cór-cia.*
Sister, *so-rêl-la*, f.
Soldier, *sol-dá-to*, m.
Soul, *á-ni-ma*, f.
Spring, *pri-ma-vê-ra*, f.
Sun, *só-le*, m.
Tells, *di-ce.*
Temperance, *tem-pe-rán-za*, f.
Three motives, *tre mo-ti-vi*, pl.
Tranquillity, *quiê-te*, f.
Treasure, *te-sô-ro*, m.
True, *vé-ro.*
Uncle, *zi-o* (*ts*), m.
Usage, *ú-so*, m.
Warmth, *ca-ló-re*, m.
Will, *vo-lon-tà*, f.
Wise man, *sá-vio*, m.
Young man, *gió-va-ne*, m.

EXERCISE 3.

Translate into Italian :—

1. The rising of the sun. 2. The dawn of the day. 3. The return of spring. 4. The warmth of the air. 5. The beauty of the flower. 6. The darkness of the night. 7. The abyss of error. 8 The fertility of the fields. 9. The colours of the rainbow. 10. Money is the soul of commerce. 11. Usage is the legislator of languages. 12. The master of the garden is not here. 13 The palace belongs to the prince. 14. Here are the rooms of the uncle. 15. The dresses belong to the cousin, and not to the aunt. 16. The brother tells the sister the will of the father. 17. The children must always obey the parents. 18. The physicians say, the disorder shortens life. 19. Exercise is useful to the body and to the mind. 20. The countenance is the mirror of the soul.

VOCABULARY.

Acqua, water.
Allegrezza (*ts*), joy.
Amicizia, friendship.
Anima, mind, soul.
Animale, animal.
Arte, art.
Assicurazione (*ts*), security, insurance.
Aurora, aurora, dawn.
Azione, action.
Ballerina(f.), dancer.
Bastone, stick
Beccheria, slaughter-house, shambles.
Carrozza (*ts*) carriage, coach.
Chiesa, church
Ciera, mien, look, air of the face.
Citta, town, city (no change in the pl.).
Collina, hill.
Con, with.
Disgrazia, misfortune, disgrace (*per dis-gra-zia*, unfortunately)
Erba, herb.
Faccia, face (*di-re in fac-cia*, to tell one to one's face).
Fanciullo, child.
Fiume, river.
Foresta, forest.
Idea, idea, notion
Immaginazione, imagination.
Inferriata, iron-grate.
Insalata, salad.
Insegna, sign, arms, colours.
Locanda, inn, hotel
Memoria, memory.
Opinione, opinion.
Osteria, public-house, tavern.
Paglia, straw
Penna, pen
Per, for, through, on account of
Porta, gate, door.
Rupe, rock.
Schioppettiere, arquebusier, rifleman.
Sciocchezza(*ts*), folly.
Scolare, pupil
Settimana, week.
Slitta, sledge.
Spianata, plain, esplanade.
Stolto, fool.
Strada, street, road.
Su, *sopra*, upon.
Unghia, nail.
Valle, valley.
Vigna, vineyard.
Vite, vine.

EXERCISE 4.

Translate into English :—

1. La me-mô-ria. 2. Al-la col-lí-na. 3. Dál-la spia-ná-ta. 4. Dél-le lo-cán-de. 5. Al-le pôr-te. 6. Dál-le strá-de. 7. In fác-cia. 8 Nél-la ví-gna. 9. Nél-le fo-rê-ste. 10. Con pá-glia. 11. Cól-la ví-te. 12. Cól-le pén-ne. 13. Per dis-grá-zia. 14. Per la vál-le. 15 Per le scioc-chéz-ze. 16. Súl-la car-rôz-za. 17. Súl-le rú-pi. 18. Dell'al-le-gréz-za. 19. All'o-pi-nió-ne. 20. Le i-dê-e. 21. Dell'êr-be. 22. Al-le ár-ti. 23. Dál-le cit-tà. 24. Nell'im-ma-gi-na-zió-ne. 25. Nél-le á-ni-me. 26. Con ác-qua. 27. Coll'ún-ghia. 28. Cól-le in-sé-gne. 29. Per a-mi-cí-zia. 30. Per l'as-si-cu-ra-zió-ne. 31. Per le a-zió-ni. 32. Súl-le in-fer-riá-te. 33. Un fan-ciúl-lo. 34. U-no stól-to. 35. D'un fiú-me. 36. Da ú-na bal-le-rí-na. 37. In ú-na chiê-sa. 38. Con un ba-stó-ne. 39. Su d'un sás-so, só-pra un sás-so.

VOCABULARY.

Com-prá-to, bought.
E-gli ha, he has.
E-gli-no han-no, they have.
I-o hó, I have.
Il giar-dí-no, the garden.
Lo zí-o, the uncle.
La zí-a, the aunt.
Nói ab-biá-mo, we have.
Nó-stro (m.), our.
Tu hai, thou hast.
Ve-dú-to, seen.
Vó-stro (m.), your.
Vói a-vé-te, you have.

EXERCISE 5 (COLLOQUIAL).

Translate into English :—

1. I-o hô un lí-bro e u-na pén-na. 2. Tu hai un buôn lí-bro e ú-na buô-na pén-na. 3. Hô un gran lí-bro, mí-a so-rêl-la ha án-che un gran lí-bro 4. Hai tu ú-na so-rêl-la ? 5. Hô ú-na so-rêl-la ed un fra-têl-lo. 6. Hai tu la mí-a pén-na ? 7. Hô il tú-o lí-bro e la tú-a pén-na. 8. Ab-biá-mo un buôn pá-dre ed ú-na buô-na má-dre. 9. Il giar-dí-no è grán-de. 10. Hô un píc-co-lo lí-bro. 11. Ab-biá-mo un gran giar-dí-no. 12. Il mí-o píc-co-lo fra-têl-lo ha un buôn lí-bro 13. La mí-a píc-co-la so-rêl-la ha án-che un buôn lí-bro. 14. A-vé-te un buôn pá-dre ed ú-na buô-na má-dre. 15. A-vé-te vói án-che un fra-têl-lo ? 16. Hô com-prá-to un buôn lí-bro. 17. Mí-o fra-têl-lo ha án-che ve-dú-to un gran giar-dí-no. 18. Hai tu com-prá-to ú-na buô-na pén-na ? 19. Hô ve-dú-to il tú-o lí-bro e la tú-a pén-na. 20. A-vé-te vói ve-dú-to la mí-a píc-co-la so-rêl-la ? 21. Mí-o pá-dre ha com-prá-to un giar-dí-no. 22. Tú-a so-rêl-la ha com-prá-to un píc-co-lo lí-bro.

VOCABULARY.

A being, *un és-se-re* (*un en-te*), *m.*
Agreeable, *di-let-té-vo-le*, m.
Air, *á-ria*, f
And, *e.*
And injures, *e guá-sta*
Anger, *i-ra*, f.
Animal, *an-i-ma-le*, m.
Are, *so-no*
Beauty, *bel-léz-za* (*ts*), f.
Bird, *uc-cél-lo*, m.
Body, *cór-po*, m.
Brings, *ré-ca.*
Cause, *ca-gio-ne*, f
Creation, *cre-a-zio-ne*, f.
Creature, *cre-a-tu-ra*, f
Demands, *vuó le*
Deprives him, *lo pri-va.*
Enemy, *ne-mí-co*, m.
Envy, *in-vi-dia*, f.
Equilibrium, *e qui-li-brio*, m.
Evident proof, *pró-va ma-ni-fé-sta*, f.
Excess, *ec-cés-so*, m.
Existence, *es-i-stén-za*, f.
Father, *pá-dre.*
Fish, *pé-sce*, m (with the pl.).
Fruit, *frút-to*, m.
Give more, *dan-no piu.*
God, *Id-dí-o*, *Dí-o.*
Health, *sa-lú-te*, f.
Heaven, *cié-lo*, m.
His most precious good, *il sú-o mag-gior bé-ne*, m.
His power, *la sú-a fór-za*, f
Homage, *o-mág-gio*, m.
Humour, *flú-i-do*, m
Hypocrisy, *i-po-cri-si-a*, f.
Incontinence, *in-con-ti-nén-za*, f
Intellect, *in-gé-gno*, m
Intemperance, *in-tem pe-rán-za*, f
Is generally, *è or-di-na-ri-a-mén-te*
Is infinite, *è in-fi-ni-to*
It weakens, *és-so in-de-bo-li-sce*
Large tree, *grán-de al-be-ro*, m.
Light, *lú-ce*, f.
Like, *co me.*
Looks for, *cér-ca.*
Lord, *Si-gno-re*, m
Lust, *pia-cé-re*, m.
Man, *uó-mo*, m.
Mechanism, *me-ca-nis-mo*, m.
Misfortune, *in-fe-li-ci-ta*, f.
Nature, *na-tú-ra*, f
Necessary (translate, the necessary), *ne-ces-sa-rio*, m.
Nerve, *nér-vo*, m.
Only requires, *non do-mán-da che* (that which is).
Order, *ór-di-ne*, m.
Outburst, *a-gi-ta-zio-ne*, f.
Passion, *pas-sió-ne*, f.
Plant, *pián-ta*, f.
Pleasantness, *gio-con-di-ta*, f.
Preserver, *con-ser-va-tó-re*, m
Pride, *or-gó-glio*, m.
Reason, *ra-gió-ne*, f.
Renders, *rén-de.*
Requires, *es-i-ge.*
Riches, *ric chéz-za* (*ts*), f. (with the pl.).
Scope, *scó-po*, m.
Sea, *má-re*, m.
Self-love, *a-mór pró-prio*, m.
Shadow, *óm-bra*, f.
Star, *stél-la*, f
Superfluous, *su-pér-fluo*, m.
Supreme, *su-pré-mo.*
System, *si sté-ma*, m.
Than, *che*
The greatest damage, *il più gran dan-no*, m.
Useful, *ú-ti-le*, m.
Vice, *ví-zio*, m
Virtue, *vir-tù*, m.
Weak, *de-bi-le.*
Which, *che.*
Who, *che.*
Wisdom, *sa-pién-za*, f.
Work, *ó-pe-ra*, f.
World, *món-do*, m.

EXERCISE 6.

Translate into Italian :—

1. Hypocrisy is a homage which vice renders to virtue. 2. Nature only requires that which is necessary. 3. Reason demands the useful, self-love looks for the agreeable, passion requires the superfluous. 4. Large trees give more shadow than fruit. 5. God is the Father of men and the Preserver of the creatures. 6. The stars of the heaven, the birds of the air, the fish of the sea, the plants, the animals, are works of the Lord. 7. The wisdom of God is like the light of heaven. 8. The order, the beauty, and the pleasantness of the world are evident proofs of the existence of a Supreme Being. 9. The excess of the passions is generally the cause of the misfortune of men. 10. The lust of intemperance and incontinence is the enemy which brings to man the greatest damage ; it weakens his powers, deprives him of riches, and injures his most precious good, the health.

We now come to some illustrative exercises of the use of *di*. That he may clearly understand the difference between the two languages, the pupil will do best, wherever it is allowable, to translate these exercises by English compound nouns, or by combinations of nouns, or by adjectives preceding nouns.

VOCABULARY.

Abito, dress.
Acconciatura, ornament, head-dress.
Aceto, vinegar.
Appello, appeal.
Argento, silver.
Arrosto, roast meat.
Barile, cask, barrel.
Bicchiere, glass.
Biglietto, note, ticket.
Birra, beer.
Bollo, official seal, stamp.
Borgogna, Burgundy.
Bottiglia, bottle.
Braccio, m. (pl. *le brác-cia*, f.), arm, ell, yard.
Butirro, butter.
Caffè, coffee.
Calza (*ts*), stocking.
Calzoni (*ts*), m. pl., trousers.
Campana, bell, clock (which strikes).
Cane, dog.
Capo, head, chief.
Cappotto, great coat or cloak.
Carne, meat.
Carta, paper, card.
Casa, house.
Cassa, box.
Cava, pit, mine, quarry.
Cavallo, horse.
Centinaio, hundred-weight.
Certificato, certificate.
Che, that.
Chicchera, cup.
Cinque, five.
Colpo, blow, shot.
Coltello, knife.
Corpo, body.
Correzione, correction.
Corsa, course, race.
Dieci, ten.
Diritto, duty, right.
Disegno, drawing.
Domani, to-morrow.
Finestra, window.
Fior (for *fió-re*), flower.
Formaggio, cheese.
Francesco, Francis.
Gennaio, January.
Gente, people.
Ghirlanda, garland.
Giorno, day.
Giovanni, John.
Giuoco, game.
Giuseppe, Joseph.
Giusto, just.
Gran (for *grán-de*), great, large.
Grande, great.
Grano, corn.
Guardia, guard (*corpo di guardia*, main guard, or main guard-house.
Ho comprato, I have bought.
Ignorante, ignorant.
Impero, empire.
Infinita, innumerable, multitude.
Inghilterra, England.
Irlanda, Ireland.
Isola, island.
Lana, wool.
Latte, milk (*fior di latte*, cream).
Levar (for *le-vá-re*, to rise), rising.
Libbra, pound.
Lotto, lottery.
Lupo, wolf.
Maestro, master, teacher.
Maggio, May.
Mantello, cloak.
Manzo(*ts*), young ox.
Marmo, marble.
Mese, month.
Miglio, m. (pl. *le miglia*, f.), (Italian) mile (of 3,000 paces), also an English, German, or French mile.
Misura, measure.
Moggio, bushel.
Monte, mountain, pawnbroker's (or Monte di pieta).
Muta, team.
Nome, name.
Numero, number.
Oglio, oil.
Opera, work (*capo d'opera*), master-piece).
Ora, hour.
Ordine, order (military).
Paio, m. (pl. *le pá-ia*, f.), pair.
Pane, bread.
Panno, cloth.
Pecora, sheep.
Penna, pen.
Pezzo (*ts*), piece.
Pietra, stone.
Pipa, (tobacco) pipe.
Pistola, pistol.
Piuma, feather.
Posta, post.
Prendetemi, take me.
Presa, pinch.
Presidio, *guarnigione*, garrison.
Punta, point.
Punto, point.
Quantita, quantity.
Quarto, fourth part, quarter (of a pound).
Rada, road, road-stead.
Razza (*ts*), race, species, kind.
Regno, kingdom.
Sardegna, Sardinia.
Scarpa, shoe.
Scherma, fencing.
Sciampagna, champagne.
Scozia (*ts*), Scotland.
Sei, six.
Sei, thou art (*pezzo d'ignorante*, blockhead, dunce).
Sentesi, one hears, is heard.
Sicilia, Sicily.
Sol (for *so-lo*), sole, only, single.
Sole, sun.
Stivale, boot.
Strada, road, way, route ; street.
Struzzo (*ts*), ostrich.
Suo, his.
Tabacco, tobacco, snuff.
Tassa, tax.
Tazza (*ts*), cup.
Te (pronounced *tè*). tea.
Tela, linen.
Tocco (pronounced *toc-co*), piece, bit.
Tocco, touch, blow, stroke.
Tonnellagio, commodity preserved in casks (*diritto di t*[illegible] nage).
Tramontar (for *tra-mon-tá-re*, to set, disappear), setting.
Tratto, throw, cast, stroke.
Tribunale, tribunal, court.
Truppa, troop.
Ufficio, office.
Vecchio, old.
Vena, vein.
Ventina, number of twenty, score.
Vetro, glass, pane.
Vino, wine.
Vista, sight, view.
Zecchino (*ts*), sequin (gold coin current at Venice and in Turkey, about 9s.).
Zio (*ts*), uncle.
Zucchero (*ts*), sugar.

EXERCISE 7.

Translate into English :

1. Il man-têl-lo del-lo zí-o. 2. L'á-bi-to di Gio-ván-ni. 3. La cá-sa di mí-a so-rêl-la. 4. Il le-vár, il tra-mon-tár del só-le. 5. Lá-na di pê-co-ra. 6. Pún-to di ví-sta. 7. La cá-sa di cor-re-zió-ne. 8. Sên-te-si un cól-po di pis-tô-la. 9. Cá-ve di piê-tra e di már-mo. 10. Il sú-o cá-po d'ô-pe-ra. 11. Il côr-po di guár-dia. 12. Con un sol trát-to di pén-na. 13. Un tóc-co di cam-pá-na. 14. Vé-tro di fi-nê-stra. 15. Ú-na ghir-lán-da di fió-ri. 16. Pêz-zo d'i-gno-rán-te che sêi! 17. La pún-ta di col-têl-lo. 18. Ú-na vé-na d'ar-gên-to. 19. Do-má-ni è giór-no di pô-sta. 20. Ma-ê-stro di di-sé-gno, di schér-ma. 21. Cer-ti-fi-cá-to d'uf-fí-cio. 22. Im-pê-ro d'Aú-stria. 23. Ré-gno d'In-ghil-têr-ra, di Scô-zia, d'Ir-lán-da. 24. La cit-tà di Lôn-dra, d'E-din-búr-go, di Dub-lí-no. 25. Il mé-se di Gen-ná-io, di Mág-gio. 26. L'í-so-la di Si-cí-lía, di Sar-dé-gna. 27. Un quár-to d'ó-ra. 28. U-na ráz-za di cá-ni. 29. Cór-sa di ca-vál-li. 30. Le trúp-pe di pre-sí-dio, di guar-ni-gió-ne.

VOCABULARY.

April, *A-prí-le*.
Asks for, *do-mán-da*.
Ball, *bál-lo*, m.
Bread, *pá-ne*, m.
Button, *bot-tó-ne*, m.
By, *per*.
Changeable, *va-riá-bi-le*.
City, *cit-tà*, f.
Cloth, *pán-no*, m.
Coffee, *caf-fe*, m.
December, *De-cêm-bre*.
Dozen, *doz-zi-na* (*ds*), f.
Dress, *á-bi-to*, m.
Eat, *man-giá-te*.
Find me, *cer-cá-te-mi*.
Finish drinking, *fi-ni-te di be-re*.
Glass, *bic-chié-re*, m.
Half an ounce, *méz-za ón-cia*, f.
He had given him, *gli fú-ro-no as-se-gná-te*.
Hour, *ó-ra*, f.
I come, *vén-go*.
I shall return, *ri-tor-ne-rò* (pron. *ri-tor-ne-ró*).
January, *Gen-ná-io*.
Loaf, *pá-ne*, m.
London, *Lón-dra*.
Map, *cár-ta geo-grá-fi-ca*, f.
Master, *pa-dró-ne*, m.
May, *Mág-gio*.
Month, *mé-se*, m.
Nine, *nó-ve*.
On the contrary, *all'in-cón-tro*.
Order, *ór-di-ne*, m.
Paris, *Pa-ri-gi*.
Performance (*i.e.*, comedy), *com-mé-dia*, f.
Pleasant, *a-mé-no*.
Pound, *líb-bra*, f.
Preparation, *pre-pa-ra-zi-óne*, f.
Quarter, *quár-to*, m.
Room, *cá-me-ra*, f., *sót-to*, below, underneath.
Roughest, *il più ri-gi-do*.

Send for,	*man-dá-te a prĕn-de-re.*
Silk,	*sé-ta,* f.
Small crust,	*cro-sti-no,* m.
Sugar,	*zúc-che-ro (ts),* m
Tailor,	*sar-tó-re,* m.
Take,	*pren-dé-te.*
That are to be made,	*che si fác-cia no.*
To-morrow,	*gior-no di do-ma-ni.*
To-morrow,	*do-má-ni.*
To tell you,	*a dir-vi.*
Two,	*dú-e.*
Very,	*mol-to.*
Were you,	*sié-te stá-ti.*
What,	*che.*
Will you put on,	*met-te-ré-te.*
Wine,	*vi-no,* m.
Yard,	*brac-cio,* m. (pl. *le brac-cia,* f.)
Year,	*an-no* (with the genitive), m.
Yesterday,	*ié-ri.*

Exercise 8.

Translate into Italian :—

1. The tailor asks for nine yards of cloth, two dozen of buttons, and half an ounce of silk. 2. Send for a loaf of sugar and two pounds of coffee. 3. I shall return in a quarter of an hour. 4. Finish this glass of wine, and eat this small crust of bread. 5. Take the map and find me the city of Paris and the city of London. 6. I come by order of the master to tell you that the preparations for to-morrow are to be made. 7. The month of April is changeable, the month of May, on the contrary, is very pleasant. 8. The months of December and January are the roughest in the year. 9. Were you at the performance yesterday? 10. He had given him the lower rooms.

ELOCUTION.—IX.

[*Continued from p.* 174.]

RULES ON EXPRESSIVE TONE (*continued*).

Rule 4.—*Awe* has usually a "suppressed" force, a "very low" note, and a "very slow" movement. *Solemnity, reverence,* and *sublimity* have a "moderate" force, a "low" note, and a "slow" movement. All four of these emotions are uttered with "effusive medial stress," and deep, but "pure," "pectoral quality"; together with a prevalent "monotone."

Note.—When great force is expressed in the language, the tone becomes "loud" in *awe.*

Example of Awe.

O thōu unūtterable Pōtentate !
Through nāture's vāst extēnt, sublīmely grēat !—
But hēre, on thēse gigántic mountains, here
Thy grēatness, glōry, wisdom, strēngth, and spirit,
In tērrible sublīmity appèar !
Thȳ āwe-impōsing vōice is hēard,—we hēar it !—
The Almighty's fēarful vōice : attènd ! It brēaks
The sīlence, and in sōlemn wārning speaks.
Thou brēathest ! [$|_{\infty}$—] fōrest ōaks of cēnturies
Tūrn their uprōoted trūnks towārds the skies.
Thou thūnderest ! [$||_{\infty}$=] adamāntine mōuntains brēak,
Trēmble, and tōtter, and apārt are rīven !
[$_{\infty}$] At Gōd's almighty will,
The affrighted wōrld fālls hēadlong from its sphēre.
Plānets, and sūns, and sȳstems disappear !

Solemnity.

Fāther ! Thȳ hānd
Hath rēared thēse vēnerable cōlumns ; Thou
Didst wēave this verdant rōof. Thōu didst lōok dōwn
Upon the nāked ēarth, and, fōrthwith, rōse
All thēse fāir rānks of trēes. Thēy, in Thȳ sūn,
Būdded, and shōok their grēen lēaves in Thȳ brēeze,
And shōt tōwards heaven. The century-living crōw,
Whose birth was in their tōps, grew old and died
Among their brānches, till, at lāst, they stood,
As nōw they stānd, māssy and tāll and dārk,
Fit shrine for hūmble wōrshipper to hold
Commūnion with his Màker !

Reverence.

Oh ! let me ōften to thēse sōlitudes
Retire, and in Thȳ prēsence reassūre
My fēeble virtue. Hēre, its ēnemies,
The pāssions, at Thy plāiner fōotsteps shrīnk
And trēmble, and are still.
[xx_{∞}=] Be it ōurs to mēditate.
In thēse cālm shādes, Thȳ milder mājesty,
And to the bēautiful ōrder of Thȳ wōrks,
Lèarn to confōrm the ōrder of our lives !

Sublimity.

Hàil ! hōly Light, ōffspring of hēaven first bórn,—
Or, of the Etērnal, cōeternal bèam,
May I exprēss thee unblámed ? since Gód is Light
And nēver but in unapprōached light
Dwēlt from eternity,—dwēlt then in thée,
Bright ēffluence of bright ēssence increate ;
Or hēar'st thōu, rāther, pūre ethēreal strèam,
Whose fōuntain who shall tell ? Befōre the sun,
Before the heavens thou wert, and at the vōice
Of God, as with a māntle, didst invēst
The rising wōrld of wāters, dārk and dēep,
Wōn from the vōid and fōrmless infinite.

Rule 5.—*Revenge* is "loud" and "low" in utterance, when deliberate, it is "slow"—when violent, it is "quick"; it has the "medial stress"; and "aspirated," "pectoral," and "guttural quality," combined. It is marked by a prevalent "downward slide."

Examples.

ÒN them, HUSSARS !—Now give them REIN and HÈEL !
Think of the ORPHANED CHÌLD, the MURDERED SIRE :
Earth cries for BLÒOD—[||] in THÙNDER on them WHÈEL !
This hour to Europe's fall shall set the TRIÙMPH SEAL !

Shylock. There I have *anòther* bad match : a BÀNKRUPT, a PRÒDIGAL, who dare scarce *show* his *head* on the Rialto ;—a BÈGGAR, that used to come so *smug* upon the mārt : *let him look to his* BÒND : he was wont to call me ÙSURER : LET HIM LOOK TO HIS BÒND : he was wont to lend money for a CHRISTIAN CÒURTESY : *LET HIM LOOK TO HIS BÒND !*

Rule 6.—*Scorn* is characterised by "loudness," by drawling "slowness," and a tone which, in the emphatic words, begins on a "high," and slides to a "low" note ; by "thorough stress," and often a laughing "tremor," making the beginning, the middle, and the end of every emphatic sound distinct and prominent and cutting to the ear. The "quality" of the voice in this tone is strongly "aspirated," but not guttural ; the "inflection" is usually "falling," but sometimes becomes the "wave" or "circumflex."

Example.

Thou SLÀVE, THOU WRETCH, *THOU COWARD!*
Thou little *văliant*, great in *villainy!*
Thou ever *strŏng* upon the *strŏnger side!*
Thou FŎRTUNE'S *champion*, that dost *nĕver fight*
But when her *hŭmorous lădyship* is *by*
To teach thee *săfety!*
Pale, TRÈMBLING CÒWARD!—[*Tremor*] *there* I throw my
gàge:
By *that*, and all the rights of knighthood *èlse*,
Will I make *gòod* against thee, *arm* to ÀRM,
What I have *spóke*, or thou canst worse *devise*.

Rule 7.—Indignation is marked by full "loudness," "low" note, and deliberate "slowness"; a swelling "medial stress"; and the effect arising from the blending of "pectoral" and "guttural" tone, to all the extent consistent with "pure" "orotund," in vehement style. The characteristic inflection is uniform "falling."

Example.

In this complicated crisis of *dànger*, *wèakness*, and *càlamity*, terrified and insulted by the *neighbouring pòwers*, unable to *àct* in America, or acting only to be DESTRÒYED, WHERE | is the MAN || who will venture to flatter us with the hope of success from *persèverance* in measures productive of *these dire effects?*—Whò | has the EFFRÒNTERY to attempt it? WHERE || is *that man!* *Let* him, if he DÀRE, STAND FORWARD, and SHOW his FÀCE.

Rule 8.—Courage, joy, ardent love, and *ardent admiration* are distinguished by "loud," "high," and "lively" utterance; swelling "medial stress"; perfectly smooth and "pure" "quality" of tone; and frequent "falling" inflections.

Example of Courage and Ardent Admiration.

Now | for the FIGHT!—*now* | for the CÀNNON PEAL!—
FÒRWARD!—through BLOOD, and TÒIL, and CLOUD and
FÌRE!
Glorious— the SHÒUT, the SHOCK, the crash of STÈEL,
The VOLLEY'S RÒLL, the RÒCKET'S BLASTING SPÌRE.

Joy.

Thou Child of Jòy!
SHÒUT round me: let me HÈAR thy shouts, *thou happy Shepherd Bòy!*

Ardent Love and Admiration.

Oh! speak again, bright àngel; for thou art
As glorious to this sight, being o'er my head,
As is a *winged messenger of hèaven*
Unto the white upturned wondering eyes
Of *mortals*, that fall back to *gaze* on him,
When he bestrides the lazy-pacing clouds,
And sails upon the bosom of the air.

Rule 9.—Excessive grief and *sorrow* are expressed by "loud," "high," and "slow" utterance; "tremor," or "intermittent stress;" and "pure" "quality," where not interrupted by sob, or "aspiration." The "falling inflection" prevails throughout the utterance of these emotions.

Example.

Capulet. Hà! let me *see* her:—*Out, alàs!* she's *còld*:
Her blood is sèttled; and her joints are stiff;
Life and these lips have long been sèparated;
Death lies on her, like an untimely fròst
Upon the sweetest flower of all the field.
Accursed time! unfòrtunate old man!
Lady Capulet. ACCURSED, UNHAPPY, WRÈTCHED, HÀTEFUL day!
Most MISERABLE hour *that e'er time saw*,
In lasting labour | of his pilgrimage!
But *òne, pòor òne*, ÒNE PÓOR and LOVING CHÌLD,
But *òne* thing to rejoice and solace in,
And cruel *death* | hath *catched* it from my *sight!*

Rule 10.—*Moderate grief and sorrow, pity*, and *tender love and admiration* are expressed by "softened force," "high" notes, and slow "movement"; by prolonged and swelling "medial stress;" and by "pure," but "chromatic," or plaintive utterance. The "rising inflection," in the form of "semitone" (half-tone), prevails in the expression of these emotions.

Example of Moderate Grief.

Enamoured *death*, with sweetly pensive grace,
Was *awful beauty* to his silent face.
No more his sad eye looked me into *tears!*
Closed was that eye, beneath his *pàle, cold brow;*
And on his *calm lips*, which had *lost* their *glow*,
But which, though *pale*, seemed *half-unclosed to speak*,
Loìtered a *smile*, like *moonlight* on the *snow*.

Pity.

Morn cáme again;
But the young lamb was *dead*.
Yet the poor mother's fond distress
Its every art had tried
To shield, with sleepless tenderness,
The weak one at her side.
Round it, all night, she gathered warm
Her woolly limbs,—her head
Close curved across its feeble fŏrm;
Day dawned, and it was dead.
It lay before her stiff and còld;
Yet fondly she assayed
To cherish it in love's warm fòld;
Then restless trial măde,
Moving, with still reverted făce,
And lŏw complaining bleat,
To entice from their damp resting-place
Those little stiffening feet.

Tender Love and Admiration.

Hushed were his *Gertrude's lips*, but still their bland
And beautiful expression | seemed to *melt*
With love that *còuld* not die! and still his *hand*
She presses to the *heart* no *more* that *felt*,
[o] *Ah! heart, where once each fond affection dwèlt*,
And *features* | yet | that spoke a *soul mòre fair!*

Rule 11.—*Impatience, eagerness*, and *hurry* are denoted by "loud," "high," and "quick movement"; *impatience*, by "vanishing," or final "stress"; *eagerness*, by "expulsive medial stress"; *hurry*, by abrupt "radical" or initial "explosive" "stress"; all three emotions are sometimes marked by the "tremor," and by "aspirated," and sometimes "anhelose" or panting utterance—*eagerness* occasionally by the "orotund." The "falling inflection" characterises the tones of these emotions.

Example of Impatience.

Mortimer. Fie! cousin Percy—how you cróss my father!
Hotspur. I cannot choose: sometimes he angers me,
With telling me of the *móldwarp* and the *ant*,
Of the dreamer *Mérlin*, and his *prophecies*;
And of a *dragon*, and a *finless fish*,
A *clip-winged griffin*, and a *moulten ràven*,
A *couching lion*, and a *ramping cat*,
And such a deal of SKIMBLE SKAMBLE STÚFF,
As puts me from my *faith*. I tell you what,—
He held me, but *last night*, at least NINE HÒURS,
In reckoning up the several DEVILS' names
That were his *lackeys*: I cried "*humph!*"—and "*wèll!*"
"*go to!*"—
But marked him not a *word*. Oh! he's as tedious
As is a *tired hòrse*, a *railing wife*;
Worse than a SMOKY HOUSE.—I had rather live
With *cheese* and *garlic* in a WINDMILL, FÀR,
Than feed on *cates* and have him TÀLK to me,
In any *summer-house* in CHRISTENDOM.

Eagerness.

Hotspur. Send danger from the *èast* unto the *wèst*
So *honour* cross it from the *north* to *south*,
And let them *grapple*:—*Oh!* the blood more stirs,
To rouse a LION, than to start a HARE.
By *hèaven*, methinks it were an easy leap,
To pluck bright honour from the *pale-faced moon*;
Or *dive* into the *bottom* of the *deep*,
Where fathom-line could never touch the *ground*,
And pluck up drownéd[*] honour by the *locks*:
So he that doth redeem her thence, might wear,
Without co-rival, all her dignities.

Hurry.

Sisters! hence, with *spurs* of *speed!*
Each her *thundering falchion wield*;
Each bestride her SABLE STEED;
HURRY! HÙRRY to the FIELD!

Rule 12.—*Melancholy* is distinguished by "soft," or faint and languid utterance, "very low pitch," and "very slow movement"; a gentle "vanishing stress"; "pure" but "pectoral" quality"; and the "monotone," or, occasionally, the plaintive "semitone."

Example.

To-mŏrrow, and to-mŏrrow, and to-mŏrrow,
Crēeps in this petty pace from dāy to dāy,
To the last syllable of recorded time;
And āll our yesterdays have lighted fōols
The wāy to dūsty dèath. *Oūt, oūt, brief candle!*
Life's but a wālking shàdow—a poor plàyer,
That strūts and frets his hōur upon the stage,
And then ‖ is heard no mòre.

Rule 13.—*Despair* has a "softened force," a "very low" note, and a "very slow movement"; "vanishing stress"; deep "pectoral quality"; and a prevalent "falling inflection" or an utter "monotone."

Example.

I have lived *long enough*; my wāy of life
Is fallen into the *sēar*, the *yĕllow leaf*:
And that which *shōuld* accompany *ōld āge*,
As *hōnour, lōve, obēdience, trōops of friends*,
I *mūst not lōok to have*; but, in their stead,
CURSES, not *loud*, but DEEP, *mouth-honour*, BREATH,
Which the *poor heart* would *fain deny*, but *dàre* not.

Rule 14.—*Remorse* has a subdued or "softened" force, very "low pitch," and "slow movement"; a strongly marked "vanishing stress"; a deep "pectoral" and "aspirated quality"; and a prevailing "falling inflection," with, occasionally, the "monotone."

Example.

Oh! my *offence* | is RÀNK.—it *smells* to HEAVEN:
It hath the *primal* | ELDEST | *curse* | upon 't,
A BROTHER'S | MURDER!—*Pray can* I not,
Though inclination be as sharp as will;
My *stronger guilt* ‖ *defeats* my *strong intent*.—
Oh! WRETCHED state! Oh! *bosom, black* as DEATH!
Oh! LIMÉD[†] *soul*, that, struggling to be *frée*,
Art *more engaged!*

Note.—*Self-reproach* has a tone similar to the preceding, but less in the extent of each property, except "force," in which it exceeds *remorse*, and "pitch," in which it is higher.

Example.

Oh! what a *rògue* and *peasant slave* am I!
Is it not MÒNSTROUS that this *player* here,
But in a *fiction*, a DREAM of passion,
Could *force* his soul so to his own *conceit*,
That, from her working, all his visage *wanned*,
Tears in his *eyes, distraction* in 's *aspect*,
A *broken vòice*, and his *whole function* suiting
With forms to his *conceit!* And all for *nothing!*
For HECUBA?
What's *Hecuba* to *him*, or *he* to *Hècuba*,
That he should *weep* for *her?* *Whàt* would he do,
Had he the *motive* and the *cue* for passion
That I have? He would DROWN the STÀGE with *tears*,
And *cleave* the *general ear* with HORRID SPEECH!
Make MÀD the GUILTY, and APPAL the FRÉE,
CONFOUND the IGNORANT and AMÀZE, indeed,
The *very faculties* of EYES and ÈARS.

Rule 15.—*Mirth* is distinguished by "loud," "high," and "quick" utterance; and an approach to the rapid, repeated "explosions" of laughter, in a greater or less degree, according to the nature of the passage which contains the emotion. To these properties are added "aspirated quality," and the "falling inflection," as a predominating one.

Example.

A FÒOL, A FÒOL! I MET A FÒOL i' the forest,
A MÒTLEY FÒOL;—*a miserable world*;
As I do *live* by *food*, I met a FÒOL;
Who laid him *dòwn*, and *basked* him in the *sun*
And *railed* on lady *Fòrtune* in *good tèrms*,
In GOOD SET TÈRMS, and yet *a* MÒTLEY FÒOL!

Rule 16.—*Gaiety* and *cheerfulness* are marked by

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[*] This accent is inserted to mark the necessity of pronouncing the second syllable *ed* in the word *drowned*.

[†] Pronounce the *ed* in the word *limed*.

"moderate force," "high pitch," and "lively movement"; moderate "radical stress"; and smooth, "pure quality" of tone, with varied "inflections."

Example.

Celia. I *pràу* thee, Rosalind, sweet my cóz, be *mèrry.*

Rosalind. Well, I will *forgèt* the condition of *my* estate, to *rejóice* in *yòurs.* From henceforth I *will*, coz, and devise *spòrts;* let me *sèe;* what think you of falling in *love?*

Celia. I prythee, *do*, to make *spòrt* withal; but love no man in good *earnest.*

Rosalind. *Whàt* shall be our *spòrt*, then?

Celia. Let us *sit* and *mock* the *good housewife*, *Fòrtune*, from her *whèel*, that her *gifts* may henceforth be bestowed *equally.*

Rosalind. I would we *còuld* do so; for her benefits are *mightily misplàced;* and the *bountiful* | *blind* | *woman* | doth *most* mistake her *gifts* to *wòmen.*

Rule 17.—*Tranquillity*, *serenity*, and *repose* are indicated by "moderate force," "middle pitch," and "moderate movement"; softened "medial stress"; "smooth" and "pure quality" of tone; and moderate inflections.

Example.

How sweet the moonlight sleeps upon this bànk!
Here will we sìt, and let the sounds of mùsic
Creep in our èars! soft stillness, and the night,
Becóme the touches of sweet hàrmony.
Look how the floor of heaven
Is thick inlaid with patines of bright gold!
There's not the smallest orb which thou behold'st,
But | in his motion | like an àngel | sings,
Still quiring to the young-eyed cherubim:
Such harmony is in immortal sóuls!

The careful study and practice of tones cannot be too strongly urged on the attention of young readers. Reading devoid of tone is cold, monotonous, and mechanical, and false, in point of fact. It defeats the main end of reading, which is to impart thought in its natural union with feeling. Faulty tones not only mar the effect of expression, but offend the ear, by their violation of taste and propriety. Reading can possess no interest, speech no eloquence, without natural and vivid tones.

The foregoing examples should be practised with close attention and persevering diligence, till every property of the voice exemplified in them is perfectly at command.

XI.—APPROPRIATE MODULATION.

The word "modulation" is the term applied, in elocution, to those *changes* of "force," "pitch," and "movement," "stress," "quality," and "inflection" which occur, in continuous and connected reading, in passing from the peculiar tone of one emotion to that of another. "Modulation," therefore, is nothing else than giving to each tone, in the reading or speaking of a whole piece, its appropriate character and expression.

The first practical exercise which it would be most advantageous to perform in this department of elocution is to turn back to the exercises on "versatility" of voice, and repeat them till they can be executed with perfect facility and precision. The next exercise should be a review, without the reading of the intervening rules, of all the examples given under the head of "tones." A very extensive and varied practice will thus be secured in "modulation." The student should, while performing this exercise, watch narrowly, and observe exactly, every change of tone, in passing from one example to another. The third course of exercise in "modulation" is to select some of the following pieces, which are marked for that purpose, as the notation will indicate. A fourth course of practice may be taken on pieces marked by the student himself.

PROMISCUOUS EXERCISES.—I. ANTIQUITY OF FREEDOM.

[*Marked for Rhetorical Pauses, in poetry.*]

Here | are old trees, tall oaks | and gnarlèd pines,
That stream | with gray-green mosses; here | the ground
Was never trenched by spade; and flowers | spring up |
Unsown, and die ungathered. It is sweet |
To linger here, among the flitting birds,
And leaping squirrels, wandering brooks, and winds |
That shake the leaves, and scatter, as they pass,
A fragrance | from the cedars, thickly set |
With pale blue berries. In these peaceful shades,—
Peaceful, unpruned, immeasurably old,—
My thoughts | go up the long | dim | path of years,
Back | to the earliest days of liberty.
O FREEDOM! thou art not, as poets | dream,
A fair young girl, with light | and delicate limbs,
And wavy tresses | gushing from the cap |
With which the Roman master | crowned his slave ||
When he took off the gyves. A bearded man,
Armed to the teeth, art thou; one mailed hand ||
Grasps the broad shield, and one | the sword; thy brow
Glorious in beauty | though it be, is scarred ||
With tokens of old wars; thy massive limbs ||
Are strong with struggling. Power | at thee has launched
His bolts, and | with his lightnings | smitten thee;
They could not quench the life thou hast from heaven.
Merciless power | has dug thy dungeon deep,
And his swart armourers, by a thousand fires,
Have forged thy chain; yet, while he deems thee bound,
The links are shivered, and the prison walls |
Fall outward; terribly thou springest forth,
As springs the flame | above a burning pile,
And shoutest to the nations, who return
Thy shoutings, while the pale oppressor | flies.
Thy birthright | was not given | by human hands:
Thou wert twin-born | with man. In pleasant fields,
While yet our race was few, thou sat'st with him,
To tend the quiet flock | and watch the stars,
And teach the reed to utter simple airs.
Thou | by his side, amid the tangled wood,
Didst war upon the panther | and the wolf,
His only foes; and thou | with him | didst draw
The earliest furrows | on the mountain side,
Soft | with the deluge. Tyranny himself,
Thy enemy, although of reverend look,
Hoary | with many years, and far obeyed,

Is later born | than thou; and | as he meets
The grave defiance of thine elder eye,
The usurper | trembles | in his fastnesses.
Oh! not yet |
May'st thou unbrace thy corslet, nor lay by |
Thy sword; nor yet, O Freedom! close thy lids |
In slumber; for thine enemy | never sleeps,
And thou | must watch | and combat || till the day
Of the new earth | and heaven. But wouldst thou rest
Awhile | from tumult | and the frauds of men,
These old | and friendly solitudes | invite
Thy visit. They, while yet the forest trees |
Were young | upon the young unviolated earth,
And yet the moss-stains | on the rock | were new,
Beheld thy glorious childhood, and rejoiced.—*Bryant.*

II. THE PURITANS.

[*Marked for Inflections.*]

The Puritans were men whose minds had derived a peculiar character from the daily contemplation of supèrior béings and eternal interests. Not content with acknowledging, in general terms, an overrùling Próvidence, they habitually ascribed every evènt to the will of the Great Being, for whose pówer nothing was too vást, for whose inspection nothing was too minute. To knòw Him, to sèrve Him, to enjóy Him, was with them the grèat énd of existence. Théy rejected with contempt the ceremonious homage which other sects substituted for the pùre wórship of the sòul. Instead of catching occasional glimpses of the Deity through an obscùring veil, they aspired to gaze fùll on the intólerable brightness, and to commune with Him face to face. Hence originated their contempt for terrestrial distinctions. The difference between the grèatest and meanest of mankind seemed to vanish, when compared with the boundless interval which separated the whóle race from Him on whom their òwn eyes were cónstantly fixed. They recognised no title to superiority but His fávour; and, cónfident of that favour, they despised all the accòmplishments and all the dignities of the wòrld. If they were unacquainted with the works of philósophers and póets, they were dèeply read in the oracles of Gód. If their names were not found in the règisters of hèralds, they felt assured that they were recorded in the Bóok of Life. If their steps were not accompanied by a splendid train of ménials, legions of ministering angels had charge over them. Their pálaces were houses not made with hánds; their diadems, crowns of glory which should never fade awày!

On the rich and the èloquent, on nòbles and priests, they looked down with contèmpt; for they esteemed themselves rich in a more précious treasure, and eloquent in a more sublime lánguage; nobles by the right of an èarlier creátion, and priests by the imposition of a mightier hand. The very mèanest of them was a being to whose fate a mysterious and terrible importance belonged,—on whose slightest áction the spirits of light and dárkness looked with ánxious interest; who had been destined, before heaven and earth were created, to enjoy a felicity which should continue when heaven and earth should have passed awày.

Events which shortsighted politicians ascribed to éarthly causes, had been ordained on his account. For his sake, èmpires had risen, and flóurished, and decàyed. For his sake, the Almighty had proclaimed his will by the pèn of the evángelist and the harp of the pròphet. He had been rescued by nó còmmon deliverer, from the grasp of no cómmon fòe. He had been ransomed by the sweat of nó vùlgar ágony, by the blood of nò éarthly sacrifice. It was for him that the sùn had been dàrkened,* that the rócks had been rent, that the dèad had arisen, that áll náture had shuddered at the sufferings of her expiring Gòd.

Thus the Puritan was made up of twò different mèn, the one all self-abàsement, pènitence, gràtitude, passion; the other, próud, càlm, infléxible, sagacious. He próstrated himself in the dùst before his Maker; but he set his fóot on the néck of the king. In his devotional retirement, he pràyed with convùlsions, and gróans, and tèars. He was half-màddened by glórious or térrible illùsions. He heard the lýres of angels, or the tèmpting whispers of fiends. He caught a gleam of the beatific vision, or woke scréaming from dreams of everlásting fire. Like Vane, he thought himself entrusted with the scèptre of the millénnial yéar. Like Fléetwood, he cried in the bitterness of his soul, that God had hid His fàce from him. But when he took his séat in the council, or girt on his swòrd for war, these tempestuous workings of the soul had left no perceptible tràce behind them. People who saw nothing of the godly but their uncóuth visages, and heard nothing from them but their gróans and their hymns, might laugh at them. But those had little rèason to laugh who encountered them in the hall of debate, or in the field of bàttle.

The Puritans brought to civil and military affairs a cóolness of judgment, and an immutability of purpŏse, which some writers have thought inconsistent with their religious zéal, but which were in fact the necessary effects of it. The intensity of their feelings on one subject made them trànquil on èvery other. One overpówering sentiment had subjected to itself pity and hátred, ambition and fear. Death had lóst its térrors, and pleasure its charms. They had their smiles and their tears, their raptures and their sòrrows, but not for the things of this world. Enthusiasm had made them stoics, had cleared their minds from every vùlgar passion and prejudice, and raised them above the influence of danger and of corruption.—*Macaulay.*

III. POPE AND DRYDEN.

[*This piece is marked in application of the rules of Inflection.*]

Pope professed to have learnt his poetry from Drýden, whom, whenever an opportunity was presented, he praised through his whole life with unvaried liberàlity; and, perhaps, his character may receive some illustration, if he be compared with his master.

Integrity of understanding, and nicety of discernment, were not allotted in a less proportion to Drýden than to Pòpe. The rectitude of Dryden's mind was sufficiently shown by the dismission of his poetical préjudices, and the rejection of unnatural thoughts and rugged numbers. But Dryden never desired to apply all the judgment that he had. He wrote, and professed to write, merely for the people; and when he pleased others, he contented himsèlf. He spent no time in struggles to rouse latent pòwers; he never attempted to make that better which was already good, nor often to mend what he must have known to be fàulty. He wrote, as he tells us, with very little consideration: when occasion or necessity called upon him, he poured out what the present moment happened to supplý, and when once it had passed the press, ejected it from his mind; for when he had no pecuniary interest, he had no further solicitude.

Pope was not content to satisfy; he desired to excèl, and therefore always endeavoured to do his bèst; he did not court the cándour, but dared the jùdgment of his reader, and, expecting no indulgence from óthers, he showed none to himsèlf. He examined lines and words with minute and punctilious observàtion, and retouched every part with indefatigable diligence, till he had left nothing to be forgiven.

For this reason he kept his pieces very long in his hánds, while he considered and rèconsidered them. The only poems which can be supposed to have been written with such regard to the times as might hasten their publication, were the two satires of *Thirty-eight*: of which Dodsley told me, that they were brought to him by the author, that they might be fairly copied. "Every line," said he, "was then written twice over; I gave him a clean transcript, which he sent some time afterwards to me for the press, with every line written twice over a second time."

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* When an emphatic series causes, thus, a succession of falling inflections, the second one in each clause falls lower than the first.

His declaration, that his care for his works ceased at their publication, was not strictly true. His parental attention never abandoned them; what he found amiss in the first edition he silently corrected in those that followed. He appears to have revised the *Iliad*, and freed it from some of its imperfections; and the *Essay on Criticism* received many improvements, after its first appearance. It will seldom be found that he altered without adding clearness, elegance, or vigour. Pope had, perhaps, the judgment of Dryden; but Dryden certainly wanted the diligence of Pope.

In acquired knowledge, the superiority must be allowed to Dryden, whose education was more scholastic, and who, before he became an author, had been allowed more time for study, with better means of information. His mind has a larger range, and he collects his images and illustrations from a more extensive circumference of science. Dryden knew more of man in his general nature, and Pope in his local manners. The notions of Dryden were formed by comprehensive speculation, and those of Pope by minute attention. There is more dignity in the knowledge of Dryden, and more certainty in that of Pope.

Poetry was not the sole praise of either: for both excelled likewise in prose; but Pope did not borrow his prose from his predecessor. The style of Dryden is capricious and varied; that of Pope is cautious and uniform Dryden obeys the motions of his own mind; Pope constrains his mind to his own rules of composition. Dryden is sometimes vehement and rapid; Pope is always smooth, uniform, and gentle. Dryden's page is a natural field, rising into inequalities, and diversified by the varied exuberance of abundant vegetation; Pope's is a velvet lawn, shaven by the scythe and levelled by the roller.

Of genius, that power which constitutes a poet; that quality without which judgment is cold, and knowledge is inert; that energy which collects, combines, amplifies, and animates; the superiority must, with some hesitation, be allowed to Dryden. It is not to be inferred, that of this poetical vigour Pope had only a little, because Dryden had more; for every other writer since Milton must give place to Pope; and even of Dryden it must be said, that if he has brighter paragraphs, he has not better poems. Dryden's performances were always hasty, either excited by some external occasion, or extorted by domestic necessity; he composed without consideration, and published without correction. What his mind could supply at call, or gather in one excursion, was all that he sought, and all that he gave. The dilatory caution of Pope enabled him to condense his sentiments, to multiply his images, and to accumulate all that study might produce, or chance might supply. If the flights of Dryden, therefore, are higher, Pope continues longer on the wing. If of Dryden's fire the blaze is brighter, of Pope's the heat is more regular and constant. Dryden often surpasses expectation, and Pope never falls below it. Dryden is read with frequent astonishment, and Pope with perpetual delight.—*Johnson.*

BOTANY.—XXIV.

[*Continued from p.* 171.]

THALLOPHYTA—FUNGI—ALGÆ—CONCLUSION.

If we group the Characeæ with the Bryophyta, we can with considerable accuracy define the *Thallophyta* as plants in which there is no structural distinction into root, stem, and leaf. They have likewise no vessels, and but little differentiation of tissues of any kind. Whilst higher forms among them form cell-masses, and may even have a secondary growth in thickness by means of a merismatic zone, others are made up of cell-filaments either singly or interlaced in a felt-like manner, or even consist of single cells. Much of the life of many lower forms is passed in the condition of naked protoplasm or primordial cells, often ciliated and free-swimming; but in higher types this motile condition is often confined to the antherozoids. These antherozoids are in this sub-kingdom never spiral.

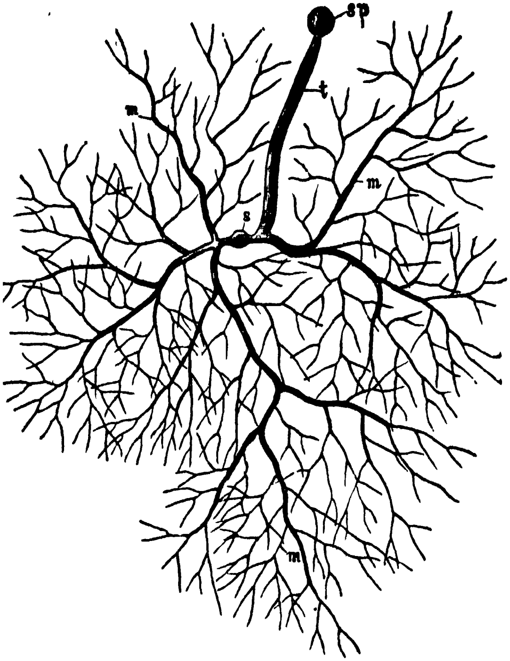

Fig. 98.—The Common Brown Mould (*Mucor Mucedo*). *s*, spore; *m*, mycelium; *t*, gonidiophore; *sp*, sporangium

There are numerous methods of reproduction, both vegetative and sexual, in the sub-kingdom. At the base of the series are types in which sex does not seem to have appeared, and at its summit are others which are apparently *apogamous*, having sometimes some sexual organs present, but dispensing altogether with any process of fertilisation. In most groups *brood-cells* are produced by a purely vegetative process. These are commonly green, ciliated primordial cells, known as *gonidia*, *zoospores*, or *zoogonidia* among Algæ, and cells neither green, ciliate, or motile among Fungi, known as *conidia*

(Greek *κονία, kŏnia*, dust). Fertilisation, where it occurs, consists either (1) in the *conjugation* or union of two similar primordial cells (*gametes*), resulting in the formation of a *zygospore ;* or (2) in the fertilisation of a relatively large germ-cell or *oosphere* by one or more small, ciliate or not ciliate, antherozoids or sperm-cells, resulting in the formation of an *oospore ;* or (3) in the fertilisation, by a motile or non-motile antherozoid or male gamete, or by an antheridium itself (*pollinodium*) of a *carpogonium* of one or more cells, which gives rise by subsequent growth to a complex *sporocarp* or spore-fruit, surrounded by an envelope produced from adjacent cells, and containing numerous spores, known as *carpospores.* Though originating in a variety of ways as the direct or the indirect result of fertilisation, there is in almost all thallophytes a unicellular organ of reproduction which becomes detached from the parent plant. This is known as the *spore*, its various modes of origin being indicated by prefixes such as zygo-spore, oo-spore, carpo-spore, asco-spore.

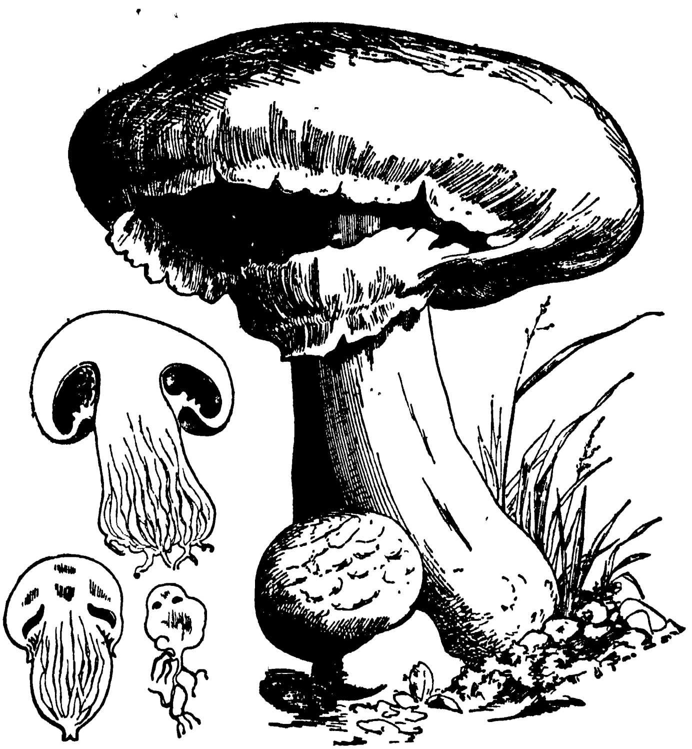

Fig. 99.—Common Mushroom (*Agaricus campestris*) ; A, Young fructification on mycelium, in section ; B, C, Later stages, also in section ; D, Mature form.

In default of any satisfactory or generally received subdivision of the Thallophyta, we fall back upon the two classes *Fungi* and *Algæ*, which are, as we have seen, distinguished mainly by the physiological character of the absence or presence of chlorophyll. Though it might be supposed that, as fungi, not containing chlorophyll, are incapable of building up their bodies from purely inorganic food, they were probably preceded by green plants in the history of evolution, it has been suggested that this need not have been so, and that chlorophyll is in many respects a comparatively late acquisition in the life of a cell, of a plant, or perhaps of the plant world. We shall, however, deal with the Fungi first, as reaching in other respects a somewhat higher grade of structure.

Fungi from the absence of chlorophyll are either parasites, living upon living plants or animals, or saprophytes, living upon decaying organic matter, or are sometimes both. They may consist of minute distinct cells, of loosely united chains of cells, of long filaments or *hyphæ*, or of a *thallus*, or more or less felted mass of such hyphæ. The hyphæ have apical growth and numerous nuclei, but in some of the lower forms (*see* Fig. 98) are not divided into cells by transverse septa. Those hyphæ which spread through the material on which the fungus lives, answering in some respects to rhizoids, are known as *mycelium*, mycelial threads, or *spawn.* They are sometimes collected together in bundles, once thought to be a distinct genus and named *Rhizomorpha*, or into tuber-like resting states, with thickened cell-walls, resisting desiccation or heat, known as *sclerotia* (Greek *σκληρός, sklēros*, hard). Besides hyphal growth some groups multiply either by a process of sprouting (*pullulation*) or by *fission*, the former exemplified by the yeast-fungus (*Saccharomyces*) and the latter by the *Schizomycetes*, such as *Bacillus*, *Bacterium*, etc. In sprouting, a protuberance forms near the end of a cell and becomes cut off by a narrowing at its base (*abstriction*).

Fungi may be provisionally grouped under five sub-classes, of which our elementary scope and limited space will only allow of our discussing a few leading types. They are the *Carpomycetes*, *Oomycetes*, *Zygomycetes*, *Myxomycetes*, and *Protomycetes*. The sub-class *Carpomycetes* includes three series, the *Basidiomycetes*, *Æcidiomycetes*, and *Ascomycetes*. The *Basidiomycetes* have no known method of sexual reproduction, but agree in the production of *basidiospores* by abstriction from the slender processes or *sterigmata* on a club-shaped cell or *basidium*, terminating a hypha. They comprise three orders, the gelatinous *Tremellini*, the *Gasteromycetes* and the *Hymenomycetes*. The *Gasteromycetes* include the puff-balls (*Lycoperdon*, etc.) and stink-horns (*Phallus*), which are *angiocarpous*, ripening their spores, that is, within a spherical "fructification," which afterwards bursts its outer layers or *peridium*.

The *Hymenomycetes** are *gymnocarpous*, the basidia on which the spores form being produced over an exposed surface or *hymenium*. The usual form in this order is the cap or umbrella-like shape familiar to us in the common mushroom. (Fig. 99.) There is a *mycelium* or "spawn" of thread-like hyphæ penetrating the ground, dead wood, or other substratum, and on it appear the "fructifications" or *gonidiophores* as rounded bud-like masses of parallel hyphæ with apical growth. (Fig. 99 A.) Each of these usually develops into a stalk or *stipes* and the cap-like *pileus*. (Fig. 99, B.) An outer layer of hyphæ (*velum universale*) burst in growth (Fig. 99, B) may form a cup-like *volva* round the base of the stipes and flocculent scales on the pileus, whilst another similar membrane (Fig. 99, C) below the pileus (*velum partiale*) may remain as a torn ring (*annulus*) round the stipes. (Fig. 99, D.) The under-surface of the pileus consists of radiating "gills" or *lamellæ* in the sub-order *Agaricini*, to which the mushroom (*Agaricus campestris*) belongs; of tubes in the tougher sub-order *Polyporei;* and of spines in the *Hydnacei*. The entire surface of these various structures is covered by the *hymenium*, a layer of club-shaped cells, some sterile (*paraphyses*), others (*basidia*) producing four slender points or branches (*sterigmata*), at the free ends of which the *gonidia* or *basidiospores* are formed, as already said, by abstriction. They are generally white, pink, or purple, and as they fall, colour the gills.

The *Æcidiomycetes* or *Uredinæ* are parasitic on the stems or leaves of flowering-plants, sometimes not only exhibiting a marked alternation of generations—different stages of which have been thought entirely distinct plants—but being also *heterœcious* (Greek *ἕτερος*, *hĕtĕrŏs*, another; *οἶκος*, *ŏikŏs*, a house), *i.e.*, passing the various stages of their development on distinct host-plants. For example, *Puccinia graminis*, wheat-mildew, has black, two-celled resting *teleútospores* (Greek *τελευτὴ*, *tĕlĕutē*, the end), which germinate in spring, producing short branched hyphæ (*promycelia*). The terminal cells of the branches of a promycelium become small round spores (*sporidia*). These will only germinate on the leaf of a barberry (*Berberis*), producing a mycelium which pierces the epidermis of the leaf and forms a dense felt between the mesophyll cells. Yellow swellings appear first on the upper and then on the lower surface of the leaf, and rounded bodies burst through the palisade and lower mesophyll tissues. Those on the upper surface are *spermogonia*, containing hyphæ, the ends of which separate as apparently functionless *spermatia*. On the lower surface are the "cluster-cups" or *æcidia*, once known as *Æcidium Berberidis*. They are filled with hyphæ or basidia, each producing a chain of orange *æcidiospores*. These æcidiospores only germinate on the green stem or leaf of a grass—wheat, for instance—producing a mycelium which enters by a stomate. Six or ten days later this mycelium gives off branches (*basidia*) which burst through the epidermis of the grass in lines bearing oval orange *uredo-spores*, once known as *Uredo segetum*. These uredo-spores germinate also on grasses, producing a mycelium entering stomata and producing fresh uredo-spores. Towards the end of summer the black two-celled *teleutospores* appear on basidia, at first among the uredo-spores, so forming the black lines often seen along a ripe piece of straw. They rest during the winter. The *æcidium* may be the result of an act of fertilisation as yet unobserved.

The *Ascomycetes* are a large group of varied and complex structure agreeing in producing spores (*ascospores*), generally eight, by repeated bipartition of the nucleus of a club-shaped cell or *ascus*. One branch of their mycelium, the *archicarp* or *ascogonium*, is sometimes fertilised by conjugation with another, the *antheridium* or *pollinodium*. The archicarp then becomes surrounded by sterile hyphæ and gives rise to tubes (*ascogenous tubes*) bearing the *asci;* but these are sometimes produced apogamously, *i e.*, without fertilisation. The asci are either in open cup-like fructifications (*apothecia*); in *perithecia* (*pyrenocarps*), with only a narrow opening above; or in *cleistocarps*, altogether closed in. Many forms multiply even more rapidly vegetatively by means of *gonidia*, erect hyphæ ending in a radiating mass of sterigmata bearing chains of spores. The chief orders of Ascomycetes are the *Discomycetes*, *Pyrenomycetes*, *Erysipheæ*, and *Tuberaceæ*. The *Discomycetes* have *apothecia*, as in the scarlet, basin-shaped "Fairies' bath" (*Peziza coccinea*) found on dead twigs in January. The edible morel (*Morchella esculenta*) belongs to this group.

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* It will be seen that the sub-classes, series, and many orders of Fungi end in the suffix *mycetes* (Greek *μύκης*, *-ητος*, *mukēs*, *-ētŏs*, a mushroom).

The *Pyrenomycetes* have *pyrenocarps* or *perithecia*. Some of them are parasitic upon living insects. The ergot of rye and other grasses (*Claviceps purpurea*) may be taken as a type. The spores germinate in the flowers of grasses, covering, penetrating, and filling the ovary with felted mycelium and bearing numerous gonidia on basidia imbedded in slime. This is the *Sphacelia* stage, once thought a distinct fungus. Then the mycelium forms a horn-shaped dark violet sclerotium, the "ergot," nearly an inch long. This rests and subsequently germinates, producing little mushroom-like fructifications or *stromata*. In the outer surface of the globular head of each stroma are sunk numerous pyrenocarps containing the asci.

The *Erysipheæ* include several of the moulds, such as *Eurotium Aspergillus-glaucus*, the mould on fruit or in the disease of the ear "otiomycosis," *Erysiphe Tuckeri*, formerly called *Oidium*, on the grape, and *Penicillium glaucum*, on cheese, etc.

The *Tuberaceæ*, or truffles, have large underground tuber-like fructifications (*cleistocarps*) with asci in a hymenium which lines parts of their interior. Their mycelia appear to live upon the dead root-tissue of trees. *Tuber æstivum* is the chief species eaten.

One of the most interesting botanical discoveries of modern times is that of the true nature of lichens, associated with the name of Schwendener. These dry, grey, or orange, dead-looking, slow-growing, but long-lived, plants, which cover alpine and polar rocks, or drape the corky stems of trees, used to be ranked as a separate class of Thallophyta with Algæ and Fungi. They are now shown to consist of some one of the lower Algæ, such as *Protococcus* or *Nostoc*, forming a layer of green cells (*the gonidial layer*), enclosed by the hyphæ of an ascomycetous fungus, belonging either to the *Discomycetes* or to the *Pyrenomycetes*, or, in two cases, of a basidiomycete. The spores of the lichen-fungus are produced in apothecia or pyrenocarps, and on germinating produce hyphæ which enclose gonidial cells or *soredia*, the two growing into a new thallus. The apothecia and pyrenocarps seem to be fructifications resulting from a sexual act. A branch hypha (*procarp*) has its basal portion twisted like a corkscrew (the *archicarp* or *ascogonium*) whilst its upper portion is a row of cells (*trichogyne*) reaching to the surface of the thallus. In special cavities in the thallus (*spermogonia*) numerous male gametes or *spermatia* are produced by abstriction from *sterigmata*. These spermatia are conveyed by water to the trichogyne, with which they conjugate, and, as a result, asci grow out from the ascogonium.

Some botanists class as simple ascomycetes the yeast fungi, *Saccharomyces*. These are unicellular fungi multiplying in saccharine solutions by a process of sprouting, and in their growth rapidly decomposing sugar into alcohol and carbon-dioxide, thus producing the disengagement of gas known as fermentation. When partially dried, yeast-cells instead of sprouting form two or four spores (*endospores* or *ascospores*) from their protoplasmic contents.

As being closely related in structure to certain algæ the *Oomycetes* and *Zygomycetes* are sometimes classed under the name *Phycomycetes*. Among the former group are the parasitic *Saprolegnia ferax*, the salmon-disease, and *Phytophthora infestans*, the potato-disease, besides saprophytic forms. The copiously branched mycelium of these moulds is generally destitute of transverse cell-walls. The end of a branch becomes rounded into an *oogonium* and a lateral branch below it forms a club-shaped *antheridium* which puts out fertilisation-tubes. *Saprolegnia*, however, is apogamous, the protoplasm not passing through the fertilisation-tube. One or more oospheres are formed in each oogonium. Asexual propagation by ciliated zoospores or by non-motile gonidia also occurs throughout this group.

Of the *Zygomycetes*, the common mould *Mucor* (Fig. 98) is a type. This plant multiplies rapidly asexually, erect hyphæ, or *gonidiophores*, rising from the mycelium to the surface of the substratum of bread, jam, fruit, or what not, and bearing a globular "sporangium" containing numerous gonidia, which bursts. Conjugation also occurs by the contact of two similar hyphal branches and the emission of their protoplasm owing to the solution of their cell-walls at the point of contact. This protoplasm forms a thick-walled resting *zygospore* between the conjugating cells. Here there is practically no distinction between the sexes.

The *Myxomycetes* or slime-fungi are a most remarkable group, often referred to the animal kingdom and exhibiting but little cellular structure. Though one of them, *Plasmodiophora*, is believed to be parasitic upon the cabbage, producing the disease called "club," most of them are saprophytic. They consist of naked masses of protoplasm (*plasmodia*), sometimes, as in the yellow *Æthalium* or "flowers of tan," of considerable size, which by a streaming movement crawl over damp surfaces. "Sporangia" originate on the plasmodium within which spores with a cellulose wall are formed, accompanied sometimes by a network (*capillitium*) of elater-like threads. The contents of the spores break up into ciliated zoospores or into shapeless *myxamœbæ* which by cohering form a new plasmodium. This seems not to be a sexual act.

Under the name *Protomycetes* (first fungi) have been classed the *Saccharomycetes* or yeast-fungi, already alluded to, and the *Schizomycetes*. The latter are extremely minute organisms, present everywhere where not artificially excluded, and multiplying with extreme rapidity, especially in organic fluids. This multiplication takes place mainly by division (Greek σχίζω, *schizō*, I divide), whence they are sometimes called also "septic organisms," and in growing and multiplying they produce those rapid fermentative decompositions into gas known as putrefaction. They are either spherical (*Micrococcus*), cylindric (*Bacterium*), rod-like (*Bacillus*), or spirally bent (*Spirillum*), and are sometimes furnished with cilia. These forms seem, at least in some cases, to be merely stages in the life of one species. Under certain conditions they form colonies of round cells imbedded in mucilage (*Zooglœa*) or they may give rise to "endospores." They are mostly killed by prolonged boiling, whence it is possible to preserve meat, fruit, etc., in hermetically sealed cases; but their germs from the surrounding air multiply in exposed organic matter so rapidly as to have given rise to the belief in their "spontaneous generation." Some of them are normally present in the secretions of the body, assisting, for instance, in digestion; others are the cause of various diseases such as splenic fever, ringworm, and phthisis. Antiseptic medicine consists in the endeavour to arrest their multiplication, whilst the rationale of such processes of inoculation as vaccination is that in certain media these fungi develop in a less virulent form, inoculation with which renders the body of an animal less suitable to nourish the virulent form.

The *Algæ*, or thallophytes containing chlorophyll, do not exhibit quite so great a variety of structure as the fungi. They may be provisionally grouped under five sub-classes, conveniently distinguished, among other characters, by colour, viz., the *Florideæ*, or *Rhodophyceæ*, or red seaweeds, containing a red colouring-matter (*rhodospermin* or *phyco-erythrin*); the *Phæophyceæ* or *Melanophyceæ*, or olive-brown seaweeds, containing the brown *phycophæin*; the *Chlorophyceæ*, or green algæ; the *Diatomaceæ*, or brittleworts, containing the yellowish *diatomin*; and the *Cyanophyceæ*, or blue-green algæ, containing the blue *phycocyan*. These various colouring-matters are in addition to chlorophyll, from which they all differ in being soluble in water, so that they can be removed by simple boiling.

The *Florideæ*, or red seaweeds, include an immense variety of species, mostly marine. Some of them, such as the Corallines (*Corallina*) and the Nullipores (*Melobesia*) are so encrusted with carbonate of lime as to resemble corals. Asexual reproduction in this group is effected by non-motile gonidia formed four together in one mother-cell, and hence known as *tetragonidia*, or, less correctly, *tetraspores*. The general character of the sexual process is similar to that which we have briefly alluded to in speaking of the lichens. Non-motile *spermatia* are formed in simple *spermogonia* or *antheridia*, and are carried by the water. There is a multicellular *procarp* with a long *trichogyne* with which the spermatia conjugate; after which the *carpogonium*, *cystocarp*, or basal portion of the procarp, shoots out into *carpospores*, and at the same time often becomes invested by barren cells forming the so-called "pericarp" of the sporocarp or fructification. *Chondrus crispus*, carrageen, or Irish moss, and several edible species known as "dulse" belong to this sub-class.

The *Phæophyceæ*, or brown seaweeds, are all marine. Two orders in this sub-class are the *Laminarieæ*, or tangles, and the *Fucaceæ*, or wracks. The *Laminarieæ* attain a greater length than the members of any other group in the vegetable kingdom, *Macrocystis* (*see* Vol. II., p. 377, Fig. 12) reaching 650 feet. They are differentiated into root, stem, and leaf-like portions, the stem having a hypodermal meristem by which it may reach a diameter of six or eight inches. The sexual process in this group has not been observed. Some forms are eaten, and the leathery stems are used as razor-strops or as imitation buck-horn.

The *Fucaceæ* include the Sargasso-weed (*Sargassum bacciferum*) and the bladder-wrack (*Fucus vesiculosus*), the commonest kelp-weed of our coasts (*see* Vol. II., p. 377), both of which are furnished with air-bladders acting as floats. *Fucus* branches dichotomously or sympodially in one plane. The sexual organs are produced monœciously or diœciously in numerous cavities (*conceptacles*) near the apices of certain branches, together with many multicellular hair-like *paraphyses*. The oogonia are single round cells on unicellular stalks, and the contents of each divides in *Fucus* into eight oospheres which are set free, before being fertilised, by the bursting of the oogonium. The antheridia are oval cells formed laterally on branched hairs, their protoplasm breaking up into numerous antherozoids. The antherozoids are ovate, pointed at one end, with two cilia at the side of the beak and a red spot in their interior; and they adhere round the oospheres, making them rotate. The fertilised oospore, having escaped from the mouth of the conceptacle, grows by division into a new plant.

The *Chlorophyceæ*, or green algæ, are, many of them, fresh-water forms, whilst some of them live as "aulophytes," or "guests," or as true parasites within the leaves of angiosperms. Some are unicellular, others filamentous, and others are cell-surfaces; but none of them reach the complexity of tissue attained by the Phæophyceæ and Florideæ. Interesting groups belonging to this sub-class are the *Conjugatæ*, including *Spirogyra* and the desmids; the *Confervaceæ*, *Protococcaceæ*, *Volvocineæ*, and *Siphoneæ*. *Spirogyra* consists of multicellular filaments with nuclei, vacuolated protoplasm, and spiral chlorophyll-bands. In conjugation cells in different filaments put out processes which meet and, their walls becoming perforated, the protoplasm of one cell (male) passes over into the other (female), and unites with its protoplasm to form a resting zygospore (*see* Vol. II., pp. 376, 380, Figs. 11, 18). In the allied *Mesocarpus*, the zygospore is formed between the filaments, as in *Mucor*. The *Desmideæ* are closely related to such forms as *Spirogyra*, but are unicellular.

The *Confervaceæ* are mostly fresh-water and filamentous, though *Ulva*, which is eaten under the name of "green laver," is marine and consists of a layer of cells. In many cases the thallus has the power of breaking up into separate cells which recommence growth independently. Zoospores occur in most forms, but the sexual processes are extremely varied, the gametes being sometimes similar, whilst in other cases there is a large oosphere and motile antherozoids.

The *Protococcaceæ* are fresh-water unicellular forms, often living on damp earth, or as aulophytes within the tissues of other plants (*entophytic*), sometimes lichens. Though each cell is capable of independent life, they sometimes, as in *Hydrodictyon*, the water-net, unite into colonies (*cœnobia*). They produce ciliated zoospores, and multiply rapidly by bipartition, whilst, as in most other Chlorophyceæ, some cells at certain seasons change their chlorophyll to a red substance (*chlororufin*) and pass into a resting condition. The green coating on the bark of trees in damp spots consists of forms belonging to this group, such as *Pleurococcus*.

The *Volvocineæ*, or "globe-animalcules," favourite microscopic objects, commonly form comparatively large colonies (*cœnobia*), of a rounded form, made up of rounded daughter-cells which each have two cilia protruding through the cell-walls of the colony and imparting a rapid movement to the whole colony. Conjugation takes place by the union of two free-swimming ciliated zoogametes.

The *Siphoneæ* are a large, mostly marine, group, remarkable as reaching a large size and considerable differentiation of form without septa in their vegetative structures, so that they must be termed either unicellular or non-cellular. Numerous nuclei occur in them. *Caulerpa*, for instance, reaches, in the Mediterranean, a length of several yards, with rhizoid, stem and leaf-like parts, but no septa. Cellulose threads do, however, in places stretch across the tubular cavity so as to strengthen it. In other forms a much-branched tube is woven together into a sort of tissue. *Vaucheria*, which grows on damp soil or in fresh or brackish water, exhibits a simple form of sexuality. Two lateral processes occur on its long tubes and are cut off by septa; one becomes a rounded oogonium containing one oosphere; the other, a hooked antheridium producing numerous ciliated antherozoids. Both organs burst, and the oospore, when fertilised, becomes a red-brown resting-spore.

The *Diatomaceæ* are unicellular, and much resemble the desmids, from which they differ in their highly silicified cell-walls and in the presence of the brown colouring-matter *diatomin*. They occur both in fresh and in salt water, increasing rapidly by bipartition. Each cell is enclosed in two silicified valves one fitting over the other like the lid of a pill-box. In division the valves separate, each forming a new and slightly smaller one on the inner side. At intervals large cells known as *auxospores* are produced and the process recommences, the daughter-cells commonly remaining slightly linked together in chains. The siliceous coverings, being marked with minute geometrical ornamentation and being practically indestructible and readily rendered transparent, are favourite microscopic objects.

Among the algæ which form the so-called gonidia of the lichens the majority seem to belong to the lowly *Cyanophyceæ*, the blue-green series. No sexual process is known in this group. Some of them, as *Glœocapsa*, occur in gelatinous groups owing to the daughter-cells of repeated divisions remaining enclosed in the mucilaginous walls of the mother-cells; others, in cell-rows, also sometimes, as in *Nostoc*, imbedded in jelly.

Though the limits of our space and the elementary scope of our work have necessarily made our reference to the lower and less familiar groups of plants very brief, we have now passed in review all the leading types of the vegetable kingdom. Apart from the interest arising from their varied uses to man, our rapid survey will have sufficed to show us that plants present an almost infinite variety of structure combined with a fundamental unity of function that can hardly fail to arouse feelings of reverential admiration in the thoughtful mind.

GERMAN.—XXXIV.

[*Continued from p.* 179.]

DEMONSTRATIVE PRONOUNS.

THE peculiar office of a demonstrative pronoun is to point out the relative *position* of the object to which it refers. Of these there are three, namely—

Dieſer, this (pointing to something *near at hand*).
Jener, that (indicating something *remote*).
Der, this *or* that (referring to things in either position).

Dieſer and jener are declined after the Old Form of adjectives, thus:—

	Singular. MASC.	FEM.	NEUT.	*Plural.* FOR ALL GENDERS.
Nom.	Dieſer	dieſe	dieſes (dies), this.	Dieſe, these.
Gen.	Dieſes	dieſer	dieſes, of this.	Dieſer, of these.
Dat.	Dieſem	dieſer	dieſem, to this.	Dieſen, to these.
Acc.	Dieſen	dieſe	dieſes (dies), this.	Dieſe, these.

Der, when used in connection with a noun, is inflected like the definite article.

When used absolutely (that is, to represent a substantive), it is inflected thus:—

	Singular. MASC.	FEM.	NEUT.	*Plural.* FOR ALL GENDERS.
Nom.	Der	die	das.	Die.
Gen.	Deſſen (deß)	deren (der)	deſſen (deß).	Deren.
Dat.	Dem	der	dem.	Denen.
Acc.	Den	die	das.	Die.

OBSERVATIONS ON THE DEMONSTRATIVES.

The neuters dieſes (contracted form dies), jenes and das are, like es, employed with verbs, without distinction of gender or number. Thus, Dies iſt ein Mann, this is a man; dies ſind Menſchen, these are men; jenes iſt eine Frau, that is a woman; etc.

Dieſer, when denoting immediate proximity, signifies *this*, as:—In dieſer Welt iſt alles vergänglich, in this world all is transitory. More generally, however, it answers in use to *that*. Jener always denotes greater remoteness than dieſer, and signifies *that*, *yon*, *yonder*, as:—Jener Stern iſt kaum ſichtbar, that (*or* yonder) star is hardly visible.

Jener and dieſer, when employed to express contrast or comparison, often find their equivalents in the English expressions *the former—the latter;* that, that one—this, this one.

The demonstrative der, die, das is distinguishable from the article with which it is identical in form, by being uttered with greater emphasis, as in the following example:—Der Mann hat es geſagt, nicht jener, *this* man has said it, not that one.

The form deß is chiefly found in compounds, as:—Deßwegen, on this account.

Sometimes der is, for the sake of greater clearness, employed in place of a possessive, as:—Er malte ſeinen Vetter und deſſen Sohn, he painted his cousin and *his* son (*lit.*, and the *son of this* one—*i.e.*, the cousin's son).

The pronouns, both demonstrative and determinative, are frequently made more *intensive* by the particle eben, *even*, *very;* eben dieſe Blume, this *very* flower; eben das Kind, that *same* child; eben derſelbe the *very* same.

DETERMINATIVE PRONOUNS.

The pronouns of this class are commonly set down among the demonstratives. Their *distinctive* feature, however, is that of being used where an antecedent is to be limited by a relative clause succeeding, and so rendered more or less prominent or emphatic; thus, Der, welcher klug handelt, verdient Lob *he* (*that* man) who acts wisely, deserves praise. From this use they derive the name *determinative*. They are—

Der, that, that one, *he*.
Derjenige, that, that person (*strongly determinative*).
Derſelbe, the same (denoting *identity*).
Selbiger, the same (seldom used).
Solcher, such (marking *similarity* of kind or nature).

Der, when used in connection with a noun, is declined like the demonstrative der—that is, like the definite article. When used *absolutely*, it differs from the demonstrative der only in the genitive plural; taking derer instead of deren.

Derjenige and derſelbe are compounded of der and the parts jenige and ſelbe respectively. In declining, both parts of each must be inflected—der like the article, and jenige and ſelbe after the New Form of adjectives. Thus:—

	Singular. MASC.	FEM.	NEUT.	*Plural.* FOR ALL GENDERS.
Nom.	Derjenige	diejenige	dasjenige.	Diejenigen.
Gen.	Desjenigen	derjenigen	desjenigen.	Derjenigen.
Dat.	Demjenigen	derjenigen	demjenigen.	Denjenigen.
Acc.	Denjenigen	diejenige	dasjenige.	Diejenigen.

Selbiger, ſelbige, ſelbiges, and ſolcher, ſolche, ſolches are declined after the Old Form of adjectives; the latter, however, when the indefinite article (ein, eine, ein) precedes, takes the *Mixed* Form.

When ein comes *after* ſolcher, the latter is not inflected at all, as:—Solch ein Mann, such a man.

Nearly synonymous with ſolcher are the words desgleichen, dergleichen, ſeinesgleichen, ihresgleichen, all which are indeclinable; as:—Ich habe keinen Umgang mit dergleichen Leuten, I have no intercourse with such people.

RELATIVE PRONOUNS.

The proper office of a relative pronoun is to represent an antecedent word or phrase; but, while so doing, it serves also to connect the different clauses of a sentence. The relatives in German are these:—

Welcher, who *or* which. Wer, who, he who, she who, [*or* that.
Der, that, who, which. So, which.

The last word is nearly obsolete. It is indeclinable, being an adverb used as a relative.

Welcher, *who* or *which*, is declined as it is when used interrogatively.

Der, *that*, is declined like the demonstrative used absolutely.

Wer, *who, he who, she who*, or *that*, is declined thus:—

Singular.

	MASC. AND FEM.	NEUT.,
Nom.	Wer	was.
Gen.	Weſſen (*or* weß)	weß.
Dat.	Wem	—
Acc.	Wen	was.

Wer has no plural, but, like es, is sometimes used before plural verbs, as:—Wer ſind dieſe Leute? who are these people? The dative singular neuter is wanting, but is supplied by an adverbial compound, as:—Wozu (wo + zu), *whereto*, or *to which;* womit, *where-with, with what;* wovon, *whereof, of what;* etc.

OBSERVATIONS ON THE RELATIVES.

Of the pronouns declined above, welcher, welche, welches is the only one that can be used in conjunction with a noun, after the manner of an adjective: thus, welcher Mann, *which man* (not wer Mann); and, except when so joined with a noun, the genitive (both singular and plural) of welcher is never used, but, in place of it, the corresponding parts of der—that is, deſſen, deren, deſſen for the singular, and deren for the plural; as:—Der Mann, deſſen (not welches) Freund ich bin, the man whose friend I am; die Bäume, deren (not welcher) Blüthen abgefallen ſind, the trees whose blossoms have fallen off.

Der, die, das, as a relative, like the English word *that*, is used as a sort of substitute for the regular relative. Thus its genitive is employed in place of that of welcher, because the genitive of the latter (welches, welcher, welches) being the same in form as the nominative masculine and neuter, might occasion mistake. So after the pronouns of the first and second person (and of *the third, when used for the second*) welcher is never employed, but der. Thus:—

Ich, der ich ihn ſah.	I, who saw him.
Du, der du uns ſegneſt.	Thou, who blessest us.
Wir, die wir hier verſammelt ſind.	We, who are here assembled.
Ihr, die ihr euer Vaterland liebt.	Ye, who love your country.
Sie, die Sie mir beiſtimmten.	You, who agreed with me.

In each case here, the personal pronoun is *repeated* after the relative. In translating, of course, the pronoun repeated is to be omitted; or, the order of the words being reversed (ich der, instead of der ich), the rendering may be *I, who saw*, etc. It must be added that when the pronoun is not repeated, the verb will be in the *third* person and in agreement with the relative, as:—Du warſt es, der es mir ſagte, thou wast the one that told me so.

Wer, was is an indefinite relative, employed wherever any uncertainty exists about the antecedent. Thus, Können Sie mir ſagen, wer dieſes gethan hat? can you tell me *who* has done this? Ich weiß nicht, was er ſagte, I do not know *what* he said.

Often, wer, was has at once the force of both a relative and an antecedent, as:—Wer auf dem Wege der Tugend wandelt, iſt glucklich, *he that* walks in the path of virtue is happy; Was gerecht iſt, verdient Lob, *what* or *that which* is right, deserves praise.

Wer always begins a clause or sentence, and never comes *after* the word which it represents; was may or may not begin a clause, and may or may not come after its proper *antecedent.* Thus, Wer nicht hören will, der muß fühlen, he who will not hear must feel; Ich ſage, was ich weiß, I say what I know; Alles, was ich geſehen habe, all that I have seen; Was gerecht iſt, verdient Lob, what is right, deserves praise.

The form weß occurs in the compounds weßwegen, weßhalb (on which *or* what account).

Welcher, -e, -es is often employed as an indefinite adjective pronoun.

INTERROGATIVE PRONOUNS.

The interrogative pronouns (that is, those used in asking questions) are the following:—

Wer? was? who? what?
Welcher? who? which?
Was fur ein? what sort of a?

They are the same in form as the relatives—or, rather, the relatives themselves employed in a different way. Wer, was, and welcher, welche, welches, are declined just as when they are relatives, except that the pronoun welcher, -e, -es, when interrogative, never adopts the genitive of der.

Wer and was (*who? what?*) can never be joined with a noun. They are used when the question is put in a manner general and indefinite. Welcher, welche, welches, on the other hand, have a more definite reference, and may be employed adjectively. Thus, Welcher Mann? which man? etc.

Was für ein (literally, *what for a?*) is a form used in inquiring as to the *kind*, *quality*, or *species* of a thing, as:—Was für ein Mann, what sort of a man? was für eine Frau? what sort of a woman? was für ein Kind? what kind of a child?

The only part of was für ein capable of inflection is ein, which, when the thing referred to in the question is *expressed*, takes the form of the indefinite article; when it is left *understood*, ein is inflected like an adjective of the Old Form. The plural, in both cases, omits the article, and stands simply thus—Was für.

OBSERVATIONS ON THE INTERROGATIVES.

Observe further, that ein, in was für ein, is sometimes omitted in the *singular*, especially before words denoting materials; as:—Was für Zeug? what sort of stuff? was für Wein? what kind of wine?

That was für ein, and also welch (that is, welcher, without the terminations of declension), are occasionally employed in expressions of surprise or wonder, as:—Was für ein Mann! *or* Welch ein Mann! what a man!

That was is sometimes used for warum. Thus, Was ſchlägſt du mich? why strikest thou me?

INDEFINITE PRONOUNS.

Pronouns employed to represent persons and things in a general way, without reference to particular individuals, are called *indefinite pronouns*. Such are these—

Man, one, a certain one.
Jemand, someone, somebody.
Niemand, no one, nobody.
Jedermann, everyone, everybody.

The following, which also belong to the list of indefinites, have already been treated of under the head of *indefinite numerals*, viz.:—

Etwas, something.
Nichts, nothing.
Keiner, no one, none.
Einer, one, someone.
Jeder, each, everyone.
Jedweder, each, everyone.
Jeglicher, each, everyone.
Einige, somewhat, some.
Etliche, some, many.
Aller, everyone, all.
Mancher, many a, many, several.

Jedermann is declined thus:—

Nom.	Jedermann, everybody.
Gen.	Jedermanns, of everybody.
Dat.	Jedermann, to everybody.
Acc.	Jedermann, everybody.

The German man (like the French *on*) is used to indicate persons in the most general manner; thus, Man ſagt, *one* says—that is, *they* say, *people* say, *it* is said, etc. It is indeclinable, and is found only in the nominative. When, therefore, any other case would be called for, the corresponding oblique case of ein is employed; thus, Er will einen nie hören, he will never listen to one (*i.e.*, to anyone).

Jemand and Niemand are declined alike, thus:—

	Singular.
Nom.	Jemand, somebody.
Gen.	Jemands *or* Jemandes, of somebody.
Dat.	Jemand *or* Jemandem, to somebody.
Acc.	Jemand *or* Jemanden, somebody.

Note that the second form of the dative (Jemandem, Niemandem) is seldom employed except when the other form would leave the meaning ambiguous. Thus, Es iſt Niemandem nützlich, it is useful to nobody; where, were Niemand used, the sense might be, *Nobody is useful.* This remark applies also to the accusative, as, Sie liebt Niemanden, she loves nobody; in which instance, were the other form (Niemand) substituted, it might mean, *Nobody loves her.*

REFLECTIVE AND RECIPROCAL PRONOUNS.

When the subject and the object of a verb are identical, the latter being a personal pronoun, the pronoun is said to be *reflective*, because the action is thereby represented as reverting upon the actor; thus, Er rühmt ſich, he praises *himself.*

When, however, in such case, the design is to represent the individuals constituting a plural subject as acting one upon another, the pronoun is said to be *reciprocal;* thus, Sie beſchimpfen ſich, they disgrace *one another.*

But as, for example, ſie beſchimpfen ſich may equally mean, "they disgrace *themselves*," the reciprocal word einander (one another) is added to or substituted for ſich wherever there is danger of mistake, as:—Sie verſtehen ſich einander *or* Sie verſtehen einander, they understand one another.

In the dative and accusative (singular and plural) the German affords a special form for the reflectives: viz., ſich, himself, herself, itself, themselves. The personal pronouns, therefore, in all the oblique cases—that is, all cases except the nominative—are used in a reflective sense, except in the dative and accusative (third person), where, instead of ihm, ihn, ihr, ꝛc., the word ſich is employed. Regarded as reflectives, the personal pronouns are declined thus:—

	Singular.	*Plural.*
	FIRST PERSON.	
Gen.	Meiner, of myself.	Unſer, of ourselves.
Dat.	Mir, to myself.	Uns, to ourselves.
Acc.	Mich, myself.	Uns, ourselves.
	SECOND PERSON.	
Gen.	Deiner, of thyself.	Euer, of yourselves.
Dat.	Dir, to thyself.	Euch, to yourselves.
Acc.	Dich, thyself.	Euch, yourselves.
	THIRD PERSON MASCULINE.	
Gen.	Seiner, of himself.	Ihrer, of themselves.
Dat.	Sich, to himself.	Sich, to themselves.
Acc.	Sich, himself.	Sich, themselves.

THIRD PERSON FEMININE.

Gen.	Ihrer, of herself.	Ihrer, of themselves.
Dat.	Sich, to herself.	Sich, to themselves.
Acc.	Sich, herself.	Sich, themselves.

THIRD PERSON NEUTER.

Gen.	Seiner, of itself.	Ihrer, of themselves.
Dat.	Sich, to itself.	Sich, to themselves.
Acc.	Sich, itself.	Sich, themselves.

VERBS.

You should already have a practical acquaintance with the German verb, but in the following pages its grammatical forms and usages are systematically treated.

A verb is that part of speech which defines the *condition* of a subject; that is, shows whether it *acts*, is *acted upon*, or merely *exists*.

In respect to *form*, verbs are either regular or irregular, simple or compound.

In respect to *meaning*, verbs are active transitive, active intransitive, passive, neuter, reflexive, or impersonal. These terms have in German the same general signification which they have in English.

The German, like the English verb, has its moods, tenses, numbers, persons, and participles.

There are *five* moods—viz., the indicative, the subjunctive, the conditional,* the imperative, and the infinitive.

There are *six* tenses—viz., the present, the past, the present perfect, the pluperfect, the future imperfect, and the future perfect.

Both moods and tenses designate in German just the same things which the corresponding ones do in English.

PARTICIPLES.

There are two participles—viz., the *present*, which terminates in -end, and answers in signification to the English participle in *-ing*, as:—Lobend, prais*ing*.

The *present perfect*, which, besides prefixing in most cases the augment ge-, ends in verbs of the Old Form in -en or -n, and those of the New Form in -et or -t, and has a meaning corresponding to our participle in *-ed*, as:—Getragen (ge + trag + en), carri*ed*; gelobt (ge + lob + t), prais*ed*.

The particle ge- (mentioned above as being generally prefixed to the perfect participle) was originally designed, it would seem, to indicate *completed* action. The instances in which it is altogether *omitted* are these:—

(1) In the case of all verbs compounded with *inseparable* prefixes, as:—Belehrt (not gebelehrt), *informed.*

(2) In the case of verbs from foreign languages which make the infinitive in -iren or -ieren, as:—Studirt (from ſtudiren), *studied*, instead of geſtudirt.

(3) In the case of the verb werden when joined as an auxiliary to another verb, as:—Ich bin gelobt worden (not geworden), *I have been praised.*

A future participle may be found by prefixing the particle zu (*to*) to the form of the present participle; thus, Zu lobend, which means *to be praised*—that is, *praiseworthy*.

AUXILIARY VERBS.

In German the auxiliary verbs are usually divided into two classes.

The first class consists of three verbs, without which no complete conjugation can be formed. They are—Haben, *to have*; ſein, *to be*; and werden, *to become.* These verbs, though chiefly employed as auxiliaries, are often themselves in the condition of *principal* verbs. In that case, they *aid one another* in the formation of the compound tenses, as may be seen in the paradigms.

As auxiliaries, these three verbs enter into the composition of the compound tenses, active and passive, of all classes of verbs.

Haben is used in forming the present perfect, pluperfect, and future perfect tenses in the active voice. Thus, from loben, *to praise*, we have—

Present Perfect.	Ich habe gelobt, I *have* praised.
Pluperfect.	Ich hatte gelobt, I *had* praised.
Future Perfect.	Ich werde gelobt haben, I *shall have* praised.

Sein is used in forming the present perfect, pluperfect, and future perfect tenses, both in the active and passive. Thus, from loben, *to praise*, and wachſen, *to grow*, we have—

	Active.	*Passive.*
Present Perfect.	Ich bin gewachſen, I *have* grown.	Ich bin gelobt worden, I *have* been praised.
Pluperfect.	Ich war gewachſen, I *had* grown.	Ich war gelobt worden, I *had* been praised.
Future. Perfect.	Ich werde gewachſen ſein, I *shall have* grown.	Ich werde gelobt worden ſein, I shall *have* been praised.

In the formation of these tenses, wherever any part of ſein occurs, it is rendered into English by the corresponding part of the verb haben; thus, Ich bin gewachſen, I *have* grown, etc. This arises from the necessity of suiting the translation to our own language, which in these places requires the verb To *Have.*

Werden is used in forming the future tenses and the conditionals. Thus, from loben, *to praise*, we have—

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* The *conditional* is made up of the imperfect subjunctive of the auxiliary verb werden (which see), and the present and perfect infinitive of another verb. It is used to denote what is also often denoted by the subjunctive (imperfect and pluperfect), namely, a *supposed condition* of things—*i.e.*, *possibility* without *actuality*. By some it is treated as a distinct *mood*; by others, it is made to consist of two *tenses*. Its *use* is the same in both views.

	Futures.	*Conditionals.*
(1)	Ich werde loben, I *shall* praise.	Ich würde loben, I *should* praise.
(2)	Ich werde gelobt haben, I *shall have* praised.	Ich würde gelobt haben, I *should* have praised.

Werden is also employed with the past participle of a principal verb, to form the passive voice. Note, also above, that werde and würde are rendered by their equivalents *shall* and *should* in the conjugation of the English verb.

REMARKS ON THE USE OF Haben AND Sein.

As the present perfect and pluperfect tenses of verbs must be conjugated, sometimes with haben and sometimes with ſein, it becomes important to know when to use the one and when the other. The determination of this question depends chiefly upon the *signification* of the main verb. The general rules are the following:—

(1) Haben is to be used in conjugating all *active transitive verbs*, all *reflexive verbs*, all *impersonal verbs*, all the auxiliaries of the second class (viz., dürfen, können, mögen, wollen, ſollen, müſſen, and laſſen), and *many intransitives.*

(2) Sein is to be used in conjugating all *intransitive* verbs signifying a change of the condition of the subject, as:—Gedeihen, to prosper; geneſen, to recover; reifen, to ripen; ſchwinden, to dwindle; ſterben, to die; all verbs indicating motion towards or from a place, as:—Eilen, to hasten; gehen, to go; reiten, to ride; ſinken, to sink; and also all verbs in the passive voice.

(3) Some verbs take in the formation of these tenses either haben or ſein, according as they are employed in one sense or in another. This, however, will be best understood by practice in reading and speaking. The following are examples:—

Er iſt in ſeinem neuen Wagen fortgefahren.	He has driven off in his new carriage.
Mein Bruder hat fortgefahren deutſch zu leſen.	My brother has proceeded to read German.
Das Waſſer iſt gefroren.	The water is (has) frozen.
Den armen Mann hat es in dem kalten Zimmer gefroren.	It has chilled the poor man in the cold room.
Das Schiff iſt auf einen Felſen geſtoßen.	The ship has struck upon a rock.
Das Volk hat den König vom Throne geſtoßen.	The people have thrust the king from the throne.
Das Schiff iſt ans Ufer getrieben.	The ship has been driven upon the shore.
Der Baum hat neue Zweige getrieben.	The tree has shot forth new branches.

PARADIGMS OF THE AUXILIARIES OF THE FIRST CLASS.

You have already learnt how to conjugate the auxiliary verbs at least in the indicative mood; but for the sake of completeness we shall set the whole verbs before you now.

(1) Haben, *to have.*

INDICATIVE MOOD.

	PRESENT.		PAST.
Sing.	Ich habe, I have.	*Sing.*	Ich hatte, I had.
	Du haſt.		Du hatteſt.
	Er hat.		Er hatte.
Plur.	Wir haben.	*Plur.*	Wir hatten.
	Ihr habt.		Ihr hattet.
	Sie haben.		Sie hatten.

	PRESENT PERFECT.		PLUPERFECT.
Sing.	Ich habe gehabt, I have had.	*Sing.*	Ich hatte gehabt, I had had.
	Du haſt gehabt.		Du hatteſt gehabt.
	Er hat gehabt.		Er hatte gehabt.
Plur.	Wir haben gehabt.	*Plur.*	Wir hatten gehabt.
	Ihr habt gehabt.		Ihr hattet gehabt.
	Sie haben gehabt.		Sie hatten gehabt.

	FUTURE IMPERFECT.		FUTURE PERFECT.
Sing.	Ich werde haben, I shall have.	*Sing.*	Ich werde gehabt haben. I shall have had.
	Du wirſt haben.		Du wirſt gehabt haben.
	Er wird haben.		Er wird gehabt haben.
Plur.	Wir werden haben.	*Plur.*	Wir werden gehabt haben.
	Ihr werdet haben.		Ihr werdet gehabt haben.
	Sie werden haben.		Sie werden gehabt haben.

SUBJUNCTIVE MOOD.

	PRESENT.		PAST.
Sing.	Ich habe, I may have.	*Sing.*	Ich hätte, I might have.
	Du habeſt.		Du hätteſt.
	Er habe.		Er hätte.
Plur.	Wir haben	*Plur.*	Wir hätten.
	Ihr habet.		Ihr hättet.
	Sie haben.		Sie hätten.

	PRESENT PERFECT.		PLUPERFECT.
Sing.	Ich habe gehabt, I may have had.	*Sing.*	Ich hätte gehabt, I might have had
	Du habeſt gehabt.		Du hätteſt gehabt.
	Er habe gehabt.		Er hätte gehabt.
Plur.	Wir haben gehabt.	*Plur.*	Wir hätten gehabt.
	Ihr habet gehabt.		Ihr hättet gehabt.
	Sie haben gehabt.		Sie hätten gehabt.

	FUTURE IMPERFECT.		FUTURE PERFECT.
Sing.	Ich werde haben, (if) I shall have.	*Sing.*	Ich werde gehabt haben, (if) I shall have had.
	Du werdeſt haben.		Du werdeſt gehabt haben.
	Er werde haben.		Er werde gehabt haben.
Plur.	Wir werden haben.	*Plur.*	Wir werden gehabt haben.
	Ihr werdet haben.		Ihr werdet gehabt haben.
	Sie werden haben.		Sie werden gehabt haben.

CONDITIONAL MOOD.

	FUTURE IMPERFECT.		FUTURE PERFECT.
Sing.	Ich würde haben, I should have.	*Sing.*	Ich würde gehabt haben, I should have had.
	Du würdeſt haben.		Du würdeſt gehabt haben.
	Er würde haben.		Er würde gehabt haben.
Plur	Wir würden haben.	*Plur.*	Wir würden gehabt haben.
	Ihr würdet haben.		Ihr würdet gehabt haben.
	Sie würden haben.		Sie würden gehabt haben.

IMPERATIVE MOOD.

PRESENT.

Sing. Habe (du), have thou.
Habe er, let him have.
Plur. Haben wir, let us have.
Habet (ihr), have ye *or* you.
Haben ſie, let them have.

INFINITIVE MOOD.

PRESENT.	PERFECT.	FUTURE IMPERFECT.
Haben, to have.	Gehabt haben, to have had.	Haben werden, to be about to have.

PARTICIPLE.

PRESENT.	PAST.
Habend, having.	Gehabt, had.

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(2) Sein, *to be.*

INDICATIVE MOOD.

	PRESENT.		PAST.
Sing.	Ich bin, I am.	*Sing.*	Ich war, I was.
	Du biſt.		Du warſt.
	Er iſt.		Er war.
Plur.	Wir ſind.	*Plur.*	Wir waren.
	Ihr ſeid.		Ihr waret.
	Sie ſind.		Sie waren.

	PRESENT PERFECT.		PLUPERFECT.
Sing.	Ich bin geweſen, I have been.	*Sing.*	Ich war geweſen, I had been.
	Du biſt geweſen.		Du warſt geweſen.
	Er iſt geweſen.		Er war geweſen.
Plur.	Wir ſind geweſen.	*Plur.*	Wir waren geweſen.
	Ihr ſeid geweſen.		Ihr waret geweſen.
	Sie ſind geweſen.		Sie waren geweſen.

	FUTURE IMPERFECT.		FUTURE PERFECT.
Sing.	Ich werde ſein, I shall be.	*Sing.*	Ich werde geweſen ſein, I shall have been.
	Du wirſt ſein.		Du wirſt geweſen ſein.
	Er wird ſein.		Er wird geweſen ſein.
Plur.	Wir werden ſein.	*Plur.*	Wir werden geweſen ſein.
	Ihr werdet ſein.		Ihr werdet geweſen ſein.
	Sie werden ſein.		Sie werden geweſen ſein.

SUBJUNCTIVE MOOD.

	PRESENT.		PAST.
Sing.	Ich ſei, I may be.	*Sing.*	Ich wäre, I might be.
	Du ſeieſt.		Du wäreſt.
	Er ſei.		Er wäre.
Plur.	Wir ſeien.	*Plur.*	Wir wären.
	Ihr ſeiet.		Ihr wäret.
	Sie ſeien.		Sie wären.

	PRESENT PERFECT.		PLUPERFECT.
Sing.	Ich ſei geweſen, I may have been.	*Sing.*	Ich wäre geweſen, I might have been.
	Du ſeieſt geweſen.		Du wäreſt geweſen.
	Er ſei geweſen.		Er wäre geweſen.
Plur.	Wir ſeien geweſen.	*Plur.*	Wir wären geweſen.
	Ihr ſeiet geweſen.		Ihr wäret geweſen.
	Sie ſeien geweſen.		Sie wären geweſen.

	FUTURE IMPERFECT.		FUTURE PERFECT.
Sing.	Ich werde ſein, (if) I shall be.	*Sing.*	Ich werde geweſen ſein, (if) I shall have been.
	Du werdeſt ſein.		Du werdeſt geweſen ſein.
	Er werde ſein.		Er werde geweſen ſein.
Plur.	Wir werden ſein.	*Plur.*	Wir werden geweſen ſein.
	Ihr werdet ſein.		Ihr werdet geweſen ſein.
	Sie werden ſein.		Sie werden geweſen ſein.

CONDITIONAL MOOD.

	FUTURE IMPERFECT		FUTURE PERFECT.
Sing.	Ich würde ſein, I should be.	*Sing.*	Ich würde geweſen ſein, I should have been.
	Du würdeſt ſein.		Du würdeſt geweſen ſein.
	Er würde ſein.		Er würde geweſen ſein.

Plur. Wir würden ſein.	*Plur.* Wir würden geweſen ſein.
Ihr würdet ſein.	Ihr würdet geweſen ſein.
Sie würden ſein.	Sie würden geweſen ſein.

IMPERATIVE MOOD.

PRESENT.

Sing. Sei (du), be thou.
Sei er, let him be.
Plur. Seien wir, let us be.
Seid (ihr), be ye.
Seien ſie, let them be.

INFINITIVE MOOD.

PRESENT.	PERFECT.	FUTURE IMPERFECT.
Sein, to be.	Geweſen ſein, to have been.	Sein werden, to be about to be.

PARTICIPLE.

PRESENT.	PAST.
Seiend, being.	Geweſen, been

ELECTRICITY.—XIII.

[*Continued from p.* 189.]

THE QUADRANT ELECTROMETER.

SIR WILLIAM THOMSON'S Quadrant Electrometer for measuring differences of potential has more than once been referred to in the preceding lessons, and merits a more complete description than is usually accorded to it in elementary text-books. It consists essentially of the following five parts:—

1. *A movable needle.* 2. *Four fixed quadrants.* 3. *A condenser or Leyden jar.* 4. *A replenisher.* 5. *An idiostatic gauge.*

Of these five, Nos. 1 and 2 form the primary parts of the instrument, Nos. 3, 4, and 5 being auxiliary parts which take no place in its actual working, but which have for their objects the keeping of the needle charged to a definite potential, and the testing of that potential.

The needle consists of thin sheet aluminium corrugated in the direction of its length so as to combine stiffness with lightness, and shaped somewhat like a double canoe-paddle with a broad flat stem. It is placed horizontally in the four quadrants as shown in Fig. 68—which also shows its shape—and occupies a symmetrical position with respect to each pair of opposite quadrants. Through the centre of the needle and at right angles to its plane runs a platinum wire, the lower end of which dips into the Leyden jar, and the upper end of which terminates in a crosshead *c c'*. Between the crosshead and the needle is fixed a mirror *m*, upon which a beam of light can be thrown and reflected on to a scale, as in a reflecting galvanometer; an extremely small motion of rotation of the needle round the platinum wire as axis can thus be detected and measured. To each end of the crosshead is fixed a single silk fibre—as shown—the upper ends of which are attached to the top of the instrument, but are attached in such a manner that the distance between them can be increased or diminished as desired. These fibres form a bifilar suspension for the needle, which therefore takes up a definite position, controlled by the force of gravity. The farther the fibres are placed apart at the top of the instrument the greater will be the controlling force exercised by gravity on the needle, and the greater therefore must be the applied force which will turn the needle through a given angle. Clearly then, the sensitiveness of the electrometer can be increased or diminished by diminishing or increasing the distance between the points of suspension of the fibres. Besides supporting the needle, the long silk fibres also insure its thorough insulation.

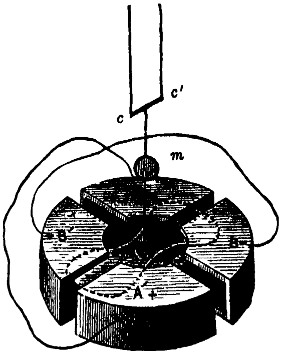


Fig. 68.

The quadrants are made from a flat circular brass box, by cutting it along two diameters at right angles to each other, and boring a hole through its centre. In the instrument the quadrants are arranged as shown in Fig. 68, A, B, A', B', enclosing the needle *u*. These quadrants are mounted on the tops of circular glass pillars, which serve the double purpose of thoroughly insulating and maintaining them in their respective positions; three of these pillars are rigidly fixed to the base of the instrument, and the fourth is mounted on a movable piece of brass in such a manner that by means of a large milled-head screw it can be either adjusted, or completely withdrawn for the purpose of inserting or removing the needle. The opposite pairs of quadrants are joined together, as shown in the figure, by means of thin copper wires. In its simplest form, the Quadrant Electrometer—with the addition of a lamp and scale—is now complete, and works in the following manner:—

The needle is charged to a high potential—let us say positively—by means of a frictional or influence machine, an electrophorus, or some high battery power. The E.M.F. that we want to measure is now attached to the opposite pairs of quadrants; this connection is made by means of two brass rods, which are fixed to the upper sides of the quadrants A and B respectively, and which project through the top of the instrument and end in suitable terminals. One pair of opposite quadrants A and A′ are now connected to the positive and the other pair B and B′ to the negative terminal of the source to be measured. Since opposite charges attract, and like charges repel each other, it is clear that the quadrant B will attract one end of the needle at the same time that A repels it, and that both of these forces tend to turn the needle in the same direction; also, the quadrant B′ attracts, and A′ repels, the other end of the needle. We have, therefore, four quadrants exerting forces on the needle, and all these forces tending to turn it in the same direction. The total twisting force is proportional to the product of the charge on the needle by the charge on the quadrants, and as the charge on the needle remains the same, the total twisting force is proportional to the charge on the quadrants. For small motions of the needle, the deflection of the spot of light on the scale is proportional to the amount of rotation, and therefore the deflection of the spot of light is a measure of the charge on the quadrants, or of the applied E.M.F. which produces that charge. By first charging the quadrants from a known E.M.F., say a Daniell cell, and noting the deflection, we can afterwards tell the value of any E.M.F. by charging the quadrants from it, and noting the deflection which will be produced.

Since the twisting force depends upon the product of the charges on the quadrants and the needle, it is clear that the greater the charge on the needle the greater will be the twisting force, and *the greater will be the sensitiveness of the instrument*. The tests often occupy a considerable time, and it is essential that the needle must have exactly the same charge during the whole of that time. If left to itself, it would be impossible to maintain the charge on the needle anything like constant; in fact, owing to its small capacity it would lose its charge extremely rapidly. In order to prevent this rapid loss of charge, the needle is placed in connection, by means of the platinum wire, with a condenser of somewhat peculiar construction, as shown in Fig. 69.

Fig. 69 shows the complete instrument. The mirror is marked *m*, the quadrants *q*, the needle is enclosed in the quadrants and is not shown, the platinum wire projecting down from the needle passes through the guard tube *t t* and ends in a plummet, whilst the greater part of the figure is occupied by the inverted glass jar *f f*. This jar is the condenser; its outer surface is partly or wholly covered with tinfoil, which forms one of the conducting surfaces, whilst the other surface consists of strong sulphuric acid, which fills about one-third of the jar. The glass is the dielectric which separates the two conducting bodies. The platinum plummet dips into the sulphuric acid, and the needle is thus permanently maintained at the same potential as the inner coat of the condenser. Besides acting as one coat of the condenser, the sulphuric acid plays another important part in the working of the electrometer; it keeps all the air about the instrument perfectly dry, and thus preserves the insulation by preventing the deposition of moisture on the different parts. The capacity of the condenser is comparatively large, and the rate at which it loses its charge is very slow; the usual rate at which an electrometer in fair working order loses its charge is about one-half per cent. per week. It is thus seen that for a series of tests extending over a few hours the charge on the needle is practically constant; but where tests are carried on from day to day, and from week to week, as they often are, serious errors would be introduced in the results if the constancy of the charge on the needle was assumed. A piece of apparatus must be used for restoring the charge lost by leakage, and

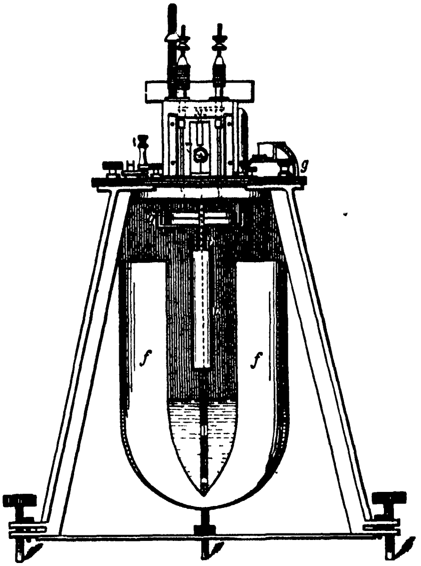


Fig. 69.—THE QUADRANT ELECTROMETER.

this piece of apparatus is known as the Replenisher.

The general appearance of the replenisher and its position relative to the top of the electrometer are shown in Fig. 70, whilst the manner in which it acts is best studied in Fig. 71. Similar letters are used for similar parts in the two figures: A and B are pieces of brass rigidly fixed to the ebonite support, and usually known as the *inductors;* C and D are also pieces of brass attached at the ends of the stout ebonite bar R, and usually known as the *carriers;* the bar R revolves about the vertical spindle E E, which terminates—above the case of the instrument—in the milled head M (Fig. 70); S and S′ are light springs, permanently joined together by the brass piece M; *s* and *s′* are light springs, one of which is connected with the sulphuric acid and with one of the inductors, and the other with the other inductor.

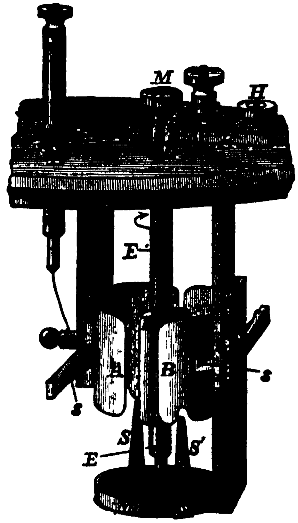


Fig. 70.—Thomson's Replenisher.

Let us suppose that the sulphuric acid—and consequently the inductor A—has a + charge, and that the carriers C and D are in contact with the springs S and S′ respectively. The + charge on inductor A will induce a — charge on carrier C, and will repel, through the connector M, a + charge on to carrier D; as the spindle rotates in the direction of the arrow, the carrier C will come into contact with the spring *s′* at the same time that the carrier D will come into contact with the spring *s*. The carriers being now inside and in contact with the inductors, will immediately give up their charges to them, so that inductor B will receive a — charge and A will have its original + charge increased by the contribution it receives from D. The carriers will now pass on without charges till carrier D comes into contact with the spring S, and carrier C comes into contact with the spring S′; while in this position inductor A will induce a — charge on carrier D, and a + charge on carrier C, whilst inductor B will induce a + charge on carrier C, and a — charge on carrier D; the effect of both inductors is therefore to induce a + charge on carrier C, and a — charge on carrier D. On further rotation of the spindle, the carriers are brought into the positions shown in Fig. 71, where carrier D is giving up its — charge to inductor B, and C is giving up its + charge to A. This cycle of operations is repeated with each revolution of the spindle, and the charge in the condenser and needle can therefore be raised to any desired amount. By following out a similar process of reasoning, it will also be seen that if the spindle be rotated in the opposite direction, the charge in the condenser and needle will be *diminished instead of being increased.*

When we have finished using the replenisher, the carriers must on no account be left in contact with the inductors, as shown in Fig. 71, as the leakage of the charge would thereby be increased, but must be left free. In order to insure that they are left in the proper position, the device shown on the top of the instrument in Fig. 70 is adopted. Attached to the head H is a pin which fits into and locks M when the carriers are free; by turning H this pin can be withdrawn. The spring K rests against a

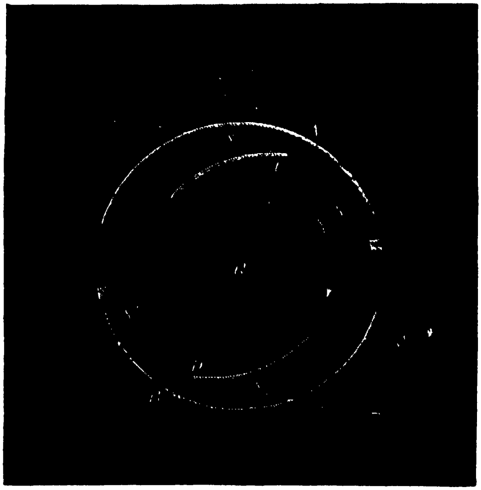


Fig. 71.—Diagram of Thomson's Replenisher.

flat face on H, so as to leave the milled head M either locked or unlocked.

The replenisher will raise or lower the charge in the condenser, but we still want something which will tell us when the charge has reached the desired amount; that something is the idiostatic gauge which is illustrated in Fig. 72. It consists of two horizontal discs placed close together, but so arranged that the distance between them can be varied by raising or lowering the under one; in the figure only the upper disc C is shown. In the centre of the upper disc a square hole is cut, and in this hole a square piece of aluminium P fits; this square forms the blade of a spade-shaped piece of aluminium, of which *h* is the handle, and F the fork at its end. The ends of the fork are joined as shown by a fine hair, and inside the fork rises a small enamelled pillar on which are two dots. The small lens *l* is used for determining the position of the hair with respect to these dots. The whole fork is suspended on a tightly strained platinum wire, which passes through two holes in the handle and over a small projection between them. The lower of the two discs is connected to the sulphuric acid, and is therefore charged to the same potential as the acid; it consequently exercises a force of attraction on the blade P, the amount of which depends upon the distance between the discs. The attraction between the blade and disc is balanced by the torsion of the platinum wire, and the handle is so bent that when the blade lies exactly in the plane of the upper disc the hair is midway between the two dots. The position of the hair, therefore, serves as an index of the charge in the condenser; if the hair is too low, the blade has risen above the plane of the upper disc, owing to the attraction between the blade and the lower disc not being sufficient; this shows that the charge in the condenser is too small, and must be increased by using the replenisher. As the charge is increased by the replenisher the attraction increases, the blade descends, and the hair rises, till, when the hair gets midway between the dots, we know that the charge has attained the desired amount. If the hair is too high, the attraction is then too great, and the replenisher must be reversed so as to diminish the charge in the condenser. Since the sensitiveness of the electrometer depends on the charge on the needle, it is clearly of advantage to be able to work with different charges and yet have a means of keeping the charge constant. This is provided for by having the lower disc movable, so that for the different charges it may exercise the same force of attraction on the blade.

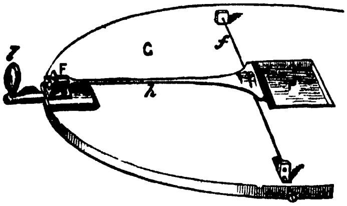


Fig. 72.—THE IDIOSTATIC GAUGE.

Where small electromotive forces are being measured, the needle must be as highly charged as possible, and the lower disc would then be at its lowest position. As thus arranged, the ordinary electrometer would give a deflection of about 50 divisions for one volt. On the other hand, when high electromotive forces are being measured, the needle must not be highly charged, which means that the lower disc must be in an elevated position. Even when the disc is in its highest position, the electrometer may be too sensitive to measure the applied E.M.F., and as the charge on the needle cannot be further lowered it becomes necessary to communicate only a definite portion of this E.M.F. to the quadrants. This is managed by means of what is called an "induction plate," which consists of a small thin brass plate attached by a glass stem to the top of the instrument, and situated horizontally over the quadrant. A terminal, marked I in Fig. 69, is attached to this plate. The electrometer can be used with the following six degrees of sensitiveness, in four of which the induction plate is brought into use:—

FIRST DEGREE.—One pole of source joined to one pair of quadrants, the other pole and other pair of quadrants joined to frame of instrument.

SECOND DEGREE.—One pole of source joined to one pair of quadrants, the other pole to frame, the other pair of quadrants insulated.

THIRD DEGREE.—One pole of source to one pair of quadrants, the other pole, the other pair of quadrants, and the induction plate joined to frame.

FOURTH DEGREE.—One pole of source joined to one pair of quadrants and induction plate, the other pole to frame, the other pair of quadrants insulated.

FIFTH DEGREE.—One pole of source to induction plate, the other pole to one pair of quadrants and frame, the other pair of quadrants insulated.

SIXTH DEGREE.—One pole of source to induction plate, the other pole to frame, both pairs of quadrants insulated.

The electrometer can be used for measuring E.M.F.'s of all kinds; it can be used instead of a condenser and ballistic galvanometer with advantage, and it is invaluable in those situations where continuous tests of high resistances are required.

COMPARATIVE ANATOMY.—II.

[*Continued from p.* 186.]

SUB-DIVISIONS OF THE ANIMAL KINGDOM—TABLE OF SUB-DIVISIONS OR CLASSES—PROTOZOA—METAZOA — PORIFERA — CŒLENTERATA — HYDROZOA.

THE main divisions into which the animal kingdom is divided were given in the last lesson. We have now to sub-divide these branches into classes, a class being the next lower denomination in our arrangement. The order in which we now enumerate the classes will be an ascending one. We shall proceed from the lowest animals to the highest. This order is evidently the more scientific, because, other things being omitted from the consideration, it is always easier to proceed from the more simple to the more complex. Thus, in chemistry it is usual first to treat of the elements, or the most simple forms of inert matter, and then to proceed to compounds, made by the unions of these elements. By this method of procedure it is true that we deprive the student of anatomy, who has just commenced the study, of a valuable aid. In studying the higher animals, a knowledge of his own body, however superficial, the consciousness of what he feels, however faulty the inductions therefrom, and the constant presence of a similar living subject on whom to experiment, all furnish illustrations to the tyro of structure in relation to life. When, however, we begin by a description of animals so far removed from himself as the Protozoa, there is nothing which he learns about them which fits in with his previous conceptions. The animals themselves can inspire him with little interest as compared with those higher beings with whom we have not only an essential community of structure, but whose very instincts and sympathies we share. The student, however, should remember that his conceptions of the phenomena of life, and his interest in animals, will dawn upon him with greater clearness and a more genial warmth, as he proceeds and arrives at the study of the higher forms, by having first mastered the successive steps by which the great problem of life has been worked out. One question must be answered before we can proceed along the road which we have decided to be the best and safest. When may an animal be said to be higher or lower than another in the scale of the animal creation? The self-complacent assumption that man is the highest animal, and that an animal is higher or lower in proportion as he is more or less like to him, will serve us but little; because, as we have seen, animals cannot be ranged in a single series, and there is no link of connection between some of the branches we have given and that to which we belong. One principle alone should guide us in our arrangement, and that is illustrated by the following axiom:—An animal may be said to be higher than another if its structure is more complex. If an animal performs many or all of the functions of life by or through one structure, it is low in the scale; but if certain parts are separated and assigned to the performance of definite vital acts, which acts are therefore done more efficiently, then the animal occupies a higher station. Just as political economists will tell us that nations are more or less civilised in proportion as the principle of the sub-division of labour is followed out in their communities, so the comparative anatomist

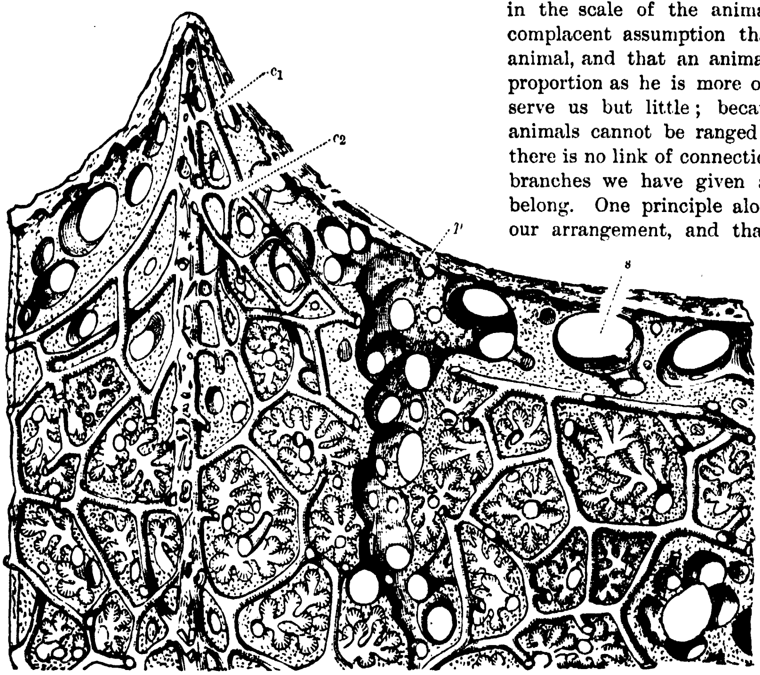


Fig. 9.—UPPER HALF OF A SECTION OF TURKEY BATH SPONGE.
p, Pore; *s*, subdermal cavity; c_1, chief fibre of the skeleton; c_2, connecting fibre.

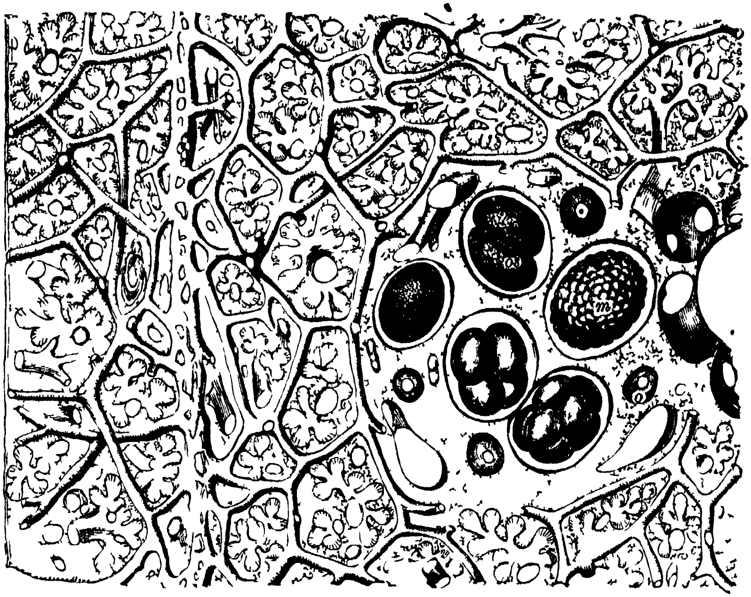


Fig 10 —Lower Half of Same o, os, m, Eggs in various stages Both magnified 40 (*After Schultze*)

will esteem that animal the highest in whose body there is the greatest division of labour This idea has given origin to a technical term, which, though barbarous English, is useful for conciseness When the reader meets with the expression that an animal manifests greater *differentiation of parts* than another, he will henceforth know not only what is meant, but also the bearings of the statement Differentiation, however, must be distinguished from *multiplication* of parts The possession by an animal of many organs all alike in function and structure, is a sign rather of a low than of a high station A worm's body is composed of very many rings, while the bee has only nineteen at most, but, with the exception of the head and tail segment of the worm, they are all alike, while every ring of the bee is dissimilar This latter animal, therefore, is much higher, because it manifests a greater differentiation of organs

In the following table we have as far as it was possible, appended a typical and familiar example or examples to each class, so that the student may have a concrete idea of each, which will at least assist his memory, and perhaps suggest much of the structure of the class to which it is appended The derivation of the names is also given, so that these terms, which are so useful for the purpose of expressing definitely each class may not be considered as mere senseless jargon —

Table of the Sub-divisions or Classes of the Animal Kingdom

	DIVISIONS	SUB DIVISIONS OR CLASSES	EXAMPLES
PROTOZOA	Protozoa	*Rhizopoda* (ριζα, *a root*, πους, *a foot*)	Sun animalcule
		Gregarinidæ (gregarious, *as sociating together*)	Internal parasite of earthworm, cockroach etc.
		Infusoria (infundo, *pour in*, *i e*, animals obtained by pouring water on different matters)	Paramecium, Vorticella
METAZOA.	Porifera (πορος *passage* φερω *I bear*)	*Spongida*	Sponge
	Cœlenterata	*Hydrozoa* (υδωρ *water*, ζῷον *a living being*)	Hydra, medusa.
		Actinozoa (ακτις, *a ray or beam*)	Sea anemone and sea daisy
	Echinodermata	*Pelmatozoa* (πελμα, *stalk*)	Sea lily
		Echinozoa (εχινος, *hedgehog*)	Sea urchin starfish
	Vermes	*Parasitic*	Tape worm
		Free	Earth worm
	Arthropoda	*Crustacea* (crusta, *a hard rind*)	Lobster crab, woodlouse
		Arachnida (αραχνη *a spider*)	Spider
		Myriopoda (μυριος *numerous* πους *a foot*)	Centipede
		Insecta (inseco *to cut up*)	Wasp butterfly
	Molluscoida	*Polyzoa* (πολυς, *many* *i e* compound animals)	Sea mat
		Brachiopoda (βραχιων, *arm*)	Lamp shell animal
	Mollusca	*Lamellibranchiata* (lamella, *a plate* branchiæ *gills*)	Cockle, mussel.
		Branchiogasteropoda (βραγχια *gills* γαστηρ *stomach*)	Whelk, limpet.
		Pulmogasteropoda (pulmo, *a lung*)	Snail, slug
		Cephalopoda (κεφαλη, *head*)	Nautilus squid.
	Vertebrata	*Tunicata*	Sea squirt
		Pisces (piscis, *a fish*)	Perch shark
		Amphibia (αμφι, *both*, βιος *life*)	Frog newt
		Reptilia (repo, *I creep*)	Lizard, turtle, snake
		Aves (avis, *a bird*)	Duck, eagle
		Mammalia (mamma, *a teat*)	Kangaroo, ox, man

PROTOZOA.

In all the animals higher than the Protozoa tissues are found which have a definite complex structure, the most constant and the ultimate element of which is a cell which is a little round or oval bag with fluid contents, and a more or less solid minute lump, called a nucleus. Many of the parts of the higher animals are entirely made up of immense multitudes of these cells closely pressed together, and none of these animals, when perfect, but exhibit a cellular structure in some of their parts. All then distinguished by the fact that their bodies consist of a number of cells may be grouped together as Metazoa or the animals that came after (μετα) the Protozoa (or first animals). In the Protozoa, however, each animal is simply a single cell. We may take as a type of the simple Protozoa the animal called the amœba (Fig. 5, p. 184), which is found in fresh-water ditches. It seems to consist of a little elastic mass of jelly-like consistence, without structure of any kind. If this little lump of glue-like matter be placed in a watch-glass under water, and observed with a microscope, it soon protrudes from its rounded exterior projections, which become extended into what may be called temporary limbs. With these it moves about, fixing some in the direction in which it is travelling; it then draws the remainder of its body towards them, while they grow shorter and disappear in the general mass, and fresh ones are put forth from any other part of the body, as the animal wills.

The mode of eating, if so it may be called, is equally simple and strange. Some of them swallow almost every substance they come near which is not too big to be surrounded by their elastic bodies. They, however, have no mouths, gullets, or stomachs, but they first gather their false limbs around the food, and then press it into the substance of their bodies, or extend themselves around it until they close it in. Whatever good can be obtained from it is dissolved, and then what remains is squeezed out again. The temporary projections are very changeful in the same animal, but they are very different in character in the different animals. In the amœba they are few, large, and thick; but in the Actinophrys they are long, thin, tapering, and stretch away in all directions, like the rays of light from the sun when veiled or surrounded with thin clouds. Like these sunbeams they neither unite nor branch, hence the animal is called the ray or sun animalcule. Another form, called Gromia, sends out projections which branch and re-branch, and run into one another wherever they meet. All these temporary limbs are called pseudopodia, which means *false legs;* and the possession of them has given them the name of root-footed animals, because of their fancied resemblance to the roots of a tree. The body substance from which they are formed is called *protoplasm.* The body substance of these simple animals is not, however, wholly alike throughout. Sometimes it breaks up into fine fragments in the internal parts, and becomes *granulated,* as it is called, and sometimes it exhibits a great many holes or cavities. These are, however, temporary modifications. On the other hand, there are usually to be found in the substance of the protoplasm two kinds of constant organs which retain their places. One of these is called the *contractile vesicle,* which keeps constantly slowly growing and then suddenly collapsing. The other is a knot of opaque matter, called the nucleus. The former is probably an organ for pumping water into and out of the body.

The more complex forms of Protozoa usually secrete on their outsides a shell whose form is often regular, complicated, and beautiful, in proportion as the process of budding is regular and symmetrical. We indicate some of the methods by which budding produces complex shells:—

1. Suppose the little lump of protoplasm to send forth a narrow neck on one side, where another little mass is developed; and then this should send forth another neck in the same straight line with the first, and the process be continued while a shell is secreted to envelop the whole, it will then be in the shape of a beaded rod.

2. If the second neck be not in the same straight line with the first, but a little to one side and in the same plane, and this mode of growth go on, a shell like that of the nautilus will be produced.

3. If, in addition to being on one side of the line of the first, it be raised a little out of its plane, this method will produce a shell like that of a trochus or top-shell, the first segment of which will be at the apex of the shell, and the last at the mouth.

4. If, as is sometimes the case, the first or second segment is not content to put forth one neck at a time, but sends out numerous ones all round the same plane, and these each put forth one to form a fresh circle outside the first, a discoid shell of concentric circles will be formed, whose outward form will be like that of a penny-piece.

These methods do not by any means exhaust the processes by which the budding of the Foraminifera (as some of the shelled Protozoa are called) produces shells, but are only examples of them.

The animals called Xiphacantha (Fig. 6, p. 185), produce most beautiful shells, differing, however, in composition from those of the Foraminifera, in that they are composed of flint and not of chalky substance; the first being represented by the chemical formula SiO_2, and the last by $CaCO_3$. These shells, of both kinds, derive much interest from the fact that they are now being deposited in immense numbers on the bed of the Atlantic Ocean. In surveying, for the purpose of laying the Atlantic telegraph, a number of cut quills, with their open ends downwards, were attached to the sounding-lead, and these ran into the mud and brought it up in their tubes. On examination under the microscope it was found to consist almost entirely of the empty shells of once living things. Thus it was found that an immense tract of sea-bottom in mid-ocean, which the off-scourings of the land—sand, mud, etc.—never reach, was being strewn with chalk and flints by these little animals, which, living on the water above, first gathered these substances from the sea, and dying, bequeathed them to form a stratum below. The great chalk formation, whose long, massive, rounded downs are found distributed all over northern Europe, once formed the bed of an ocean, and was thus built up. These chalk ranges are unstratified—that is, they are not formed of thin layers one at top of the other, as sediments strewn by tidal currents would be: they are also composed of carbonate of lime and nodules of flint. These peculiarities, together with their wide extent, accord well with this supposition as to their origin.

The Infusoria are the most complicated Protozoa, possess definite mouths, often continued inward as free hanging gullets, and the substance of their bodies is bounded by a cuticle of definite form.

One of the Infusoria, which may be taken as a type of the class, is called the Paramæcium (Fig. 7, p. 185), and it is a most interesting animal to watch. It may be found almost wherever a little animal matter is allowed to decay under water. Under the microscope it may be seen to be swimming swiftly about by means of its many cilia, which are regularly distributed over the body; near the mouth are some which are rather larger, and these continually drive food into the mouth; the food-drops pass into the body and are gradually absorbed by the living protoplasm.

One of the highest animals belonging to this subkingdom is the noctiluca (night-light) (Fig. 8, p. 186). This animal has the power of emitting light when excited, and perhaps there is no more splendid sight in nature than that which is presented on a warm summer night when a rippling wave charged with these animals breaks upon the shore. It instantly becomes fringed with a bright green phosphorescent light, which flashes along the beach, as it strikes it obliquely, in hues to which the finest shot silk, or even the green and purple which glances from the neck of the starling, are poor and dull.

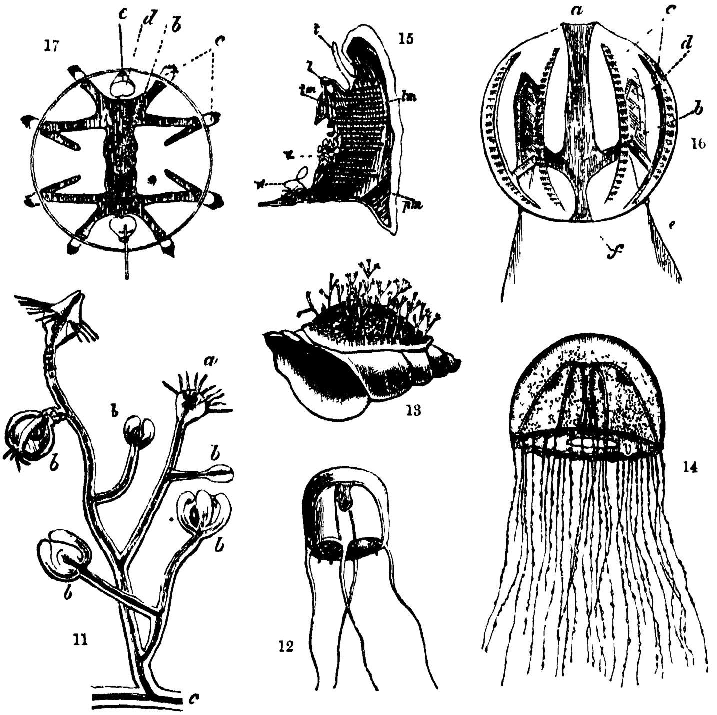
METAZOA.

All the Metazoa are distinguished from the Protozoa by the fact that the single cell—egg cell (ovum)—from which they start undergoes division into a number of cells, and all these cells remain connected as a single whole. As the cells increase in numbers they tend to become arranged in two layers, one internal to the other, and between them a third is intercalated in all the forms higher than the Porifera and the Cœlenterata. These layers are called the germinal layers; the outermost is distinguished as the epiblast, the inner as the hypoblast, and the median as the mesoblast. From these three layers all the tissues and organs of the body are developed. In the Porifera and Cœlenterata the epiblast is separated from the hypoblast by a layer of varying thickness, which is known as the mesoglœa or mid-jelly.

PORIFERA (SPONGES).

It was not till the mode of development of sponges had been studied, and they had been found to be derived from an egg cell which underwent division (or "segmentation"), that their position among the Metazoa was assured. What are ordinarily known as sponges are the fibrous skeletons of these animals. The branching fibres—which spring from a common base, and then reunite to form a dense, closely woven mass, traversed by many canals and porous throughout—are, when they grow from their submarine Levantine rock, clothed all over with living cellular tissues. Many sponges have, besides the horny skeleton, spicules, or sharp angular spines lying in the substance of their bodies, and projecting beyond their surfaces, so as to protect them from being devoured by their enemies. Both these spicules and the horny skeleton are of almost infinite variety in the different species, and exhibit another instance of how a simple form, when endowed with life, may produce very complex products.

The most interesting part of the economy of sponges is the method by which a circulation of sea-water is maintained through them. This circulation is absolutely necessary to bring both food and fresh aërated water to these fixed animals. The simple inspection of the skeleton of a large Turkish sponge shows that there are on its outside two kinds of holes—the large round ones, which lead down to the great canals, and the smaller pores, which lie between them. If a living sponge be watched, while at work under water, especially if the experiment be aided by placing some finely powdered indigo in the water, it will be found that from each of the large holes (oscula) there gushes a fountain of water, which is sucked in through the smaller pores. Lieberkühn and Carter discovered that this circulation was kept up in the following manner:—*The system of canals which commences in the deeper substance of the sponge beneath the small spores unites into larger and larger water-courses, until the final ones deliver into the great* excurrent canals which end externally in the oscula. In the course of the secondary canals small chambers are situated, which are lined with sponge particles, each of which has a long movable bristle. Each of these bristles is used, like Mrs. Partington's broom, to sweep out the waters of the ocean in one direction, towards the large excurrent canals, while fresh water flows in from behind. Professor Huxley aptly compares a sponge to a submarine city. It has roads, streets, and alleys, and the inhabitants live in houses fronting these thoroughfares, and the trade is kept up by individual but combined efforts. (Figs. 9, 10.)



Figs. 11, 12.—Eudendrium Ramosum (Hydrozoon). Fig. 13.—Hydrozoon encrusting a Shell (natural size). Fig. 14.—Figure of the Medusa of a Hydroid (after Hincks). Fig 15.—Perpendicular Section of a Sea Anemone. Fig 16—Pleurobrachia, a Ctenophore belonging to the Actinozoa. Fig. 17.—Transverse Section of Pleurobrachia (Ctenophore).

Refs. to letters in Figs—(11), *a*, feeding organs with fringe of tentacles, mouth and stomach (shaded); *b*, flower-like organs of reproduction which become detached and swim away, as in Fig 12, *c*, creeping stem (14), *v*, veil. (15), *t*, tentacle; *l*, internal septal stoma; *lm*, longitudinal muscle; *tm*, transverse muscle; *pm*, parietal muscle; *v*, mesenterial filaments; *w*, acontin. (16, 17), *a*, mouth, *b*, centre of the stomach; *c*, comb-like locomotive organs, *d*, sac into which the tentacles can be withdrawn; *e*, tentacles cut short; *f*, nerve-knot and organ of sense.

CŒLENTERATA—HYDROZOA.

The simplest of the Hydrozoa is the common fresh-water Hydra, which is hardly more than a sac with double wall and some seven extensile tentacles at its free end, round the region of the mouth.

By a process of budding many hydra-like forms give rise to a colony, and a glance at any of the more common, such as are represented in Figs. 11, 12, 13, will at once suggest that these animals have a mode of growth and a general form very similar to the higher forms of vegetables, such as grow in our fields and adorn our gardens. We may take as a typical representative of these animals a genus called *Campanularia*. The very name is similar to that given to a common garden flower, the *Campanula;* and it is given to it for the same reason. Both have at the ends of their branches cup-shaped organs, very much like bells. It is true that, in the animal, the bell, instead of hanging as a bell should, has its mouth upward; but in another respect the resemblance is better maintained, for in the centre of the bell there rises a thick club-shaped body, which may well represent the clapper. The resemblance to a plant is maintained throughout the whole of the external form of this animal. With a creeping network of roots (if we may so call them), it encrusts some submarine rock, or stone, or shell. From this it sends up branching stems, each branch of which is terminated either with a flower-like cup, which protects a tubular body with a mouth at its far end, surrounded with a circlet of feelers, or else with a fruit-like rounded organ, which, like a fruit, eventually drops off when fully developed. It is true that if we were to attempt to guess at the functions of these organs from this analogy, we should find these appearances very deceptive. These creatures never derive any nutriment through their roots or stems as plants do, but only through the little mouths at the ends of the branches. Again, the flower-like heads are in function rather like leaves than flowers. Nevertheless, whatever the function, the general plan of structure and growth is identical, and the likeness was so marked that naturalists were long before they would admit that these creatures were not plants. The animals whose branching stems are so exactly like to plants and shrubs are microscopic; but this same resemblance to vegetables is exhibited, though in a less striking form, in the higher and larger members of the sub-kingdom. If the reader, while peering into the clear waters of a pool left by the ebb of a spring tide, should see a rock covered by a multitude of flower-like heads, each with circles of purple-tipped tentacles radiating from a common centre like the anthers of the wild rose or the buttercup, all of which seem to float and sway passively with each little eddy he excited, he would certainly take them for sea flowers. Even the common *actinia*, which, when left dry on the rock, collapses into a dome of jelly, might readily be taken for a flower when, at the first approach of the sea, it expands from this bud-like condition into a spreading disc, fringed not only with tentacles, but with a circular row of bright blue knobs.

We may learn from this the value of anatomy; we see that we must not be content with the external appearance of things, but that we must make an examination of their structure before we come to any definite conclusions.

LATIN.—XXXIV.

[*Continued from p.* 198.]

THE AGRICOLA OF TACITUS (*continued*).

The Third Year of the Campaign.

22. Tertius expeditionum annus novas gentes aperuit, vastatis usque ad Tanaum (aestuario nomen est) nationibus. Qua formidine territi hostes quamquam conflictatum saevis tempestatibus exercitum lacessere non ausi; ponendisque insuper castellis spatium fuit. Adnotabant periti non alium ducem opportunitates locorum sapientius legisse; nullum ab Agricola positum castellum aut vi hostium expugnatum aut pactione ac fuga desertum; crebrae eruptiones; nam adversus moras obsidionis annuis copiis firmabantur. Ita intrepida ibi hiems, et sibi quisque praesidio, irritis hostibus eoque desperantibus, quia soliti plerumque damna aestatis hibernis eventibus pensare, tum aestate atque hieme iuxta pellebantur. Nec Agricola umquam per alios gesta avidus intercepit: seu centurio seu praefectus incorruptum facti testem habebat. Apud quosdam acerbior in conviciis narrabatur, et erat ut comis bonis ita adversus malos injucundus. Ceterum ex iracundia nihil supererat secretum, ut silentium eius non timeres: honestius putabat offendere quam odisse.

The Fourth Summer.

23. Quarta aestas obtinendis quae percucurrerat insumpta; ac si virtus exercituum et Romani nominis gloria pateretur, inventus in ipsa Britannia terminus. Namque Clota et Bodotria diversi maris aestibus per inmensum revectae, augusto terrarum spatio dirimuntur. Quod tum praesidiis firmabatur atque omnis propior sinus tenebatur, summotis velut in aliam insulam hostibus.

Ireland.

24. Quinto expeditionum anno nave prima transgressus ignotas ad id tempus gentes crebris simul ac prosperis proeliis domuit; eamque partem Britanniae quae Hiberniam aspicit copiis instruxit, in spem magis quam ob formidinem, si quidem Hibernia medio inter Britanniam atque Hispaniam sita et Gallico quoque mari opportuna valentissimam imperii partem magnis in vicem usibus miscuerit. Spatium ejus, si Britanniae comparetur, angustius, nostri maris insulas superat. Solum caelumque et ingenia cultusque hominum haud multum a Britannia differunt. Interiora parum, melius aditus portusque per commercia et negotiatores cogniti. Agricola expulsum seditione domestica unum ex regulis gentis exceperat ac specie amicitiae in occasionem retinebat. Saepe ex eo audivi legione una et modicis auxiliis debellari obtinerique Hiberniam posse; idque etiam adversus Britanniam

profuturum, si Romana ubique arma et velùt e conspectu libertas tolleretur.

Agricola's Progress in the North.

25. Ceterum aestate, qua sextum officii annum incohabat, amplexus civitates trans Bodotriam sitas, quia motus universarum ultra gentium et infesta hostibus exercitus itinera timebantur, portus classe exploravit; quae ab Agricola primum adsumpta in partem virium sequebatur egregia specie, cum simul terra, simul mari bellum impelleretur, ac saepe isdem castris pedes equesque et nauticus miles mixti copiis et laetitia sua quisque facta, suos casus attollerent, ac modo silvarum ac montium profunda, modo tempestatum ac fluctuum adversa, hinc terra et hostis, hinc victus Oceanus militari jactantia compararentur. Britannos quoque, ut ex captivis audiebatur, visa classis obstupefaciebat, tamquam aperto maris sui secreto ultimum victis perfugium clauderetur. Ad manus et arma conversi Caledoniam incolentes populi, paratu magno, majore fama, uti mos est de ignotis, oppugnare ultro castella adorti, metum ut provocantes addiderant; regrediendumque citra Bodotriam et excedendum potius quam pellerentur ignavi specie prudentium admonebant, cum interim cognoscit hostis pluribus agminbus irrupturos. Ac ne superante numero et peritia locorum circumiretur, diviso et ipse in tres partes exercitu incessit.

A Night Attack upon the Ninth Legion.

26. Quod ubi cognitum hosti, mutato repente consilio universi nonam legionem ut maxime invalidam nocte adgressi, inter somnum ac trepidationem caesis vigilibus irrupere. Jamque in ipsis castris pugnabatur, cum Agricola iter hostium ab exploratoribus edoctus te vestigiis insecutus; velocissimos equitum peditumque assultare tergis pugnantium iubet, mox ab universis adici clamorem; et propinqua luce fulsere signa. Ita ancipiti malo territi Britanni et Romanis rediit animus, ac securi pro salute de gloria certabant. Ultro quin etiam erupere. et fuit atrox in ipsis portarum angustiis proelium, donec pulsi hostes, utroque exercitu certante, his, ut tulisse opem, illis, ne eguisse auxilio viderentur. Quod nisi paludes et silvae fugientes texissent, debellatum illa victoria foret.

The Britons prepare for War.

27. Cujus conscientia ac fama ferox exercitus nihil virtuti suae invium et penetrandam Caledoniam inveniendumque tandem Britanniae terminum continuo proeliorum cursu fremebant. Atque illi modo cauti ac sapientes prompti post eventum ac magniloqui erant. Iniquissima haec bellorum condicio est: prospera omnes sibi vindicant, adversa uni imputantur. At Britanni non virtute se, sed occasione et arte ducis victos rati, nihil ex arrogantia remittere, quo minus juventutem armarent, coniuges ac liberos in loca tuta transferrent, coetibus ac sacrificiis conspirationem civitatum sancirent. Atque ita irritatis utrimque animis discessum.

The Adventures of the Usipian Cohort.

28. Eadem aestate cohors Usiporum per Germanias conscripta et in Britanniam transmissa magnum ac memorabile facinus ausa est. Occiso centurione ac militibus, qui ad tradendam disciplinam immixti manipulis exemplum et rectores habebantur, tres liburnicas adactis per vim gubernatoribus ascendere; et uno renavigante, suspectis duobus eoque interfectis, nondum vulgato rumore ut miraculum praevehebantur. Mox ad aquandum atque utilia raptum egressi et cum plerisque Britannorum sua defensantium proelio congressi ac saepe victores, aliquando pulsi, eo ad extremum inopiae venere, ut infirmissimos suorum, mox sorte ductos vescerentur. Atque ita circumvecti Britanniam, amissis per inscitiam regendi navibus, pro praedonibus habiti, primum a Suebis, mox a Frisiis intercepti sunt. Ac fuere quos per commercia venumdatos et in nostram usque ripam mutatione ementium adductos indicium tanti casus illustravit.

Agricola's March to the Grampians.—The Speech of Galgacus to his Followers.

29. Initio aestatis Agricola domestico vulnere ictus, anno ante natum filium amisit. Quem casum neque ut plerique fortium virorum ambitiose, neque per lamenta rursus ac maerorem muliebriter tulit: et in luctu bellum inter remedia erat. Igitur praemissa classe, quae pluribus locis praedata magnum et incertum terrorem faceret, expedito exercitu, cui ex Britannis fortissimos et longa pace exploratos addiderat,ad montem Grampium pervenit, quem jam hostis insederat. Nam Britanni nihil fracti pugnae prioris eventu, et ultionem aut servitium expectantes, tandemque docti commune periculum concordia propulsandum, legationibus et foederibus omnium civitatum vires exciverant. Jamque super triginta milia armatorum aspiciebantur, et adhuc adfluebat omnis juventus et quibus cruda ac viridis senectus, clari bello et sua quisque decora gestantes, cum inter plures duces virtute et genere praestans nomine Galgacus apud contractam multitudinem proelium poscentem in hunc modum locutus fertur:—

30. Quotiens causas belli et necessitatem nostram intueor, magnus mihi animus est hodiernum diem consensumque vestrum initium libertatis toti Britanniae fore; nam et universi servitutis expertes et nullae ultra terrae ac ne mare quidem securum

imminente nobis classe Romana. Ita proelium atque arma, quae fortibus honesta, eadem etiam ignavis tutissima sunt. Priores pugnae, quibus adversus Romanos varia fortuna certatum est, spem ac subsidium in nostris manibus habebant, quia nobilissimi totius Britanniae eoque in ipsis penetralibus siti nec servientium litora aspicientes, oculos quoque a contactu dominationis inviolatos habebamus. Nos terrarum ac libertatis extremos recessus ipse ac sinus famae in hunc diem defendit; atque omne ignotum pro magnifico est: sed nunc terminus Britanniae patet, nulla jam ultra gens, nihil nisi fluctus et saxa, et infestiores Romani, quorum superbiam frustra per obsequium ac modestiam effugeris. Raptores orbis, postquam cuncta vastantibus defuere terrae, jam et mare scrutantur: si locuples hostis est, avari, si pauper, ambitiosi, quos non Oriens, non Occidens satiaverit: soli omnium opes atque inopiam pari adfectu concupiscunt. Auferre, trucidare, rapere falsis nominibus imperium, atque ubi solitudinem faciunt, pacem appellant.

NOTES TO TACITUS.

Chap. XXII.—*Tanaum.* It is quite uncertain what river is here referred to.

Periti. "Men trained in war."

Opportunitates locorum. This phrase must be turned round in English—"favourable spots."

Annuis copiis. "A year's provisions."

Sibi quisque præsidio. Præsidio is here the predicative dative, and the exact meaning of the words is "each was a guard for himself," *i.e.*, "each held his own fort."

Chap. XXIII.—"The fourth summer was spent in rendering secure those parts of the country which he had hastily traversed."

Clota et Bodotria, "the firths of Clyde and Forth." *Omnis propior sinus* is the country south of the Forth and Clyde, nearer of course to the Roman territory; while the expression *velut in aliam insulam* is intelligible if you remember that the portion of Scotland lying north of the Forth and Clyde is almost an island.

Chap. XXIV.—*Transgressus.* This implies that Agricola crossed over from the Clyde.

Nave prima. The meaning of these words is a little obscure. The ship may be the first ship in the fleet, or the first Roman ship that ever visited Ireland.

Eamque partem, etc. "He furnished with troops that part of Britain which looks upon Ireland."

In spem—i.e., "In the hope (of conquest)."

Hibernia medio inter Britanniam atque Hispaniam. It seems strange to describe Ireland as between Britain and Spain, and conveniently placed for the Gallic Sea, but Tacitus thought that Spain extended farther to the north than it actually does.

Magnis in vicem usibus. "With great mutual benefits."

Interiora parum. The text here is uncertain, and different editors have adopted different readings. The words *interiora parum* are purely conjectural, but they help out the sense, and give a meaning to the *melius* that follows.

Idque etiam adversus, etc. This is a report of what Agricola said; and the clause is, therefore, constructed according to the rules of *Oratio Obliqua.*

Chap. XXV.—*Ultra gentium.* The remoter tribes, who dwelt in the Highlands.

Quae ab Agricola, etc. The meaning of this is that Agricola first employed his fleet as a part of his forces; but now that it was of no practical use, he retained it as a form of display.

Egregia specie. "With imposing effect."

Mixti copiis et laetitia. Copiis here means "provisions," and the phrase is rendered by Messrs. Church and Brodribb, "joyously sharing the same meals."

Comparentur. In English we should express this by an active verb: "And they compared with a soldier's arrogance."

Visa classis. "The sight of the fleet"

Ad manus et arma. "To arms."

Ultro. This implies that the Britons took the initiative—"unprovoked."

Ut provocantes. "Issuing the challenge.'

Ignavi specie prudentium. "The timid under the pretence of being prudent."

Cognoscit—i.e., Agricola.

Chap. XXVI.—*Pugnabatur.* "The battle was being fought"

Exploratoribus. The word *explorator* has a special military meaning, viz., "scout." In this sense it is frequently employed by Cæsar.

Propinqua luce. "At the approach of dawn."

Ultro quin etiam. The word *ultro* is used by Tacitus with remarkable effect. Here it implies that the Romans being no longer content to oppose the enemy's attack, attacked *in turn.*

Debellatum. The force of *de* in this verb should be noted: "The war would have been finished."

Chap. XXVII.—*Cujus* Scil. *victoriae.*

Nihil invium. "Nothing stood in the way of."

Modo cuncti ac sapientes. When the Britons threatened to take the offensive (*see* Chap. XXV.), the Romans thought that they should retire to the hither side of Bodotria (*regrediendum citra Bodotriam*). At the first encounter, they demanded that they should penetrate the recesses of Caledonia.

Occasione. "Opportune action."

Conspirationem. This word should be rendered "confederacy."

Chap. XXVIII.—*Usiporum.* The "Usipetes," as they are generally called, were a German tribe that dwelt on the Rhine.

Germanias. This is in the plural, because the two German provinces is meant.

Manipulis. The literal meaning of *manipulus* is a "handful." But inasmuch as in early times the standard of a company in the Roman army consisted of a pole, surmounted by a handful or bundle of hay, *manipulus* came to mean a company."

Liburnicas. "Brigantines," a sort of fast-sailing ship. The name is derived from the Liburni, a people of Illyria.

Infirmissimos suorum. The strong first ate the weak, and then drew lots for each other.

Nostram ripam. "Our bank of the river"—*i.e.*, the bank of the Rhine nearest to Rome.

Illustravit. "Rendered famous."

Chap. XXIX.—*Ambitiose. Ambitiosus*, it should be remembered, has nothing, save in one unusual sense, to do with the English word "ambition." Its primary meaning is "going round," whence it implies, "acting for the sake of vainglory or ostentation." Such is its meaning here.

Rursus. "On the contrary."

Inter remedia erat. "Was one of his reliefs."

Expedito. Expeditus is the past participle of *expedio* and means "light," "ready." Translate it here "unimpeded by baggage."

Ultionem aut servitutem expectantes. "Determined to take vengeance or accept slavery" will represent the sense.

Legationibus et foederibus. "By the sending of envoys and the conclusion of treaties."

Cruda ac viridis. "Fresh and green." *Cruda* is an uncommon epithet for old age.

Fertur. This word implies that Tacitus is not quoting the *verba ipsissima* of Galgacus, but is merely writing such a speech as Galgacus may be supposed to have made. Herein Tacitus follows the example of Thucydides.

Chap. XXX.—*Necessitatem nostram.* "Our unavoidable position."

Magnus mihi animus. Lit., "There is to me a good courage," *i.e.*, "I am quite hopeful."

Consensum vestrum, *i.e.*, the union of the various British tribes, to which reference was made in the last chapter.

Nullae ultra terrae. In Roman geography Britain was the western verge of the world.

Priores pugnae, etc. The argument of this passage is as follows:—In previous battles other tribes have contended against the Romans with varying success, and this is a good augury for us, who are of the best blood and who have never contemplated slavery.

Spem ac subsidium. Here two words are used to express a single idea according to the figure which the grammarians call hendiadys. Messrs. Church and Brodripp translate it, "hope of succour."

Nobilissimi. This word refers not to conduct but to birth, and means "the best bred" The Caledonians naturally would have suffered less from admixture with foreigners than the Britons of the south.

Oculos quoque a contactu, etc. This is a somewhat extravagant expression. It is noteworthy that Tacitus insists throughout on the Britons' love of freedom, a quality which they are said to possess even to-day.

Nos terrarum ac libertatis extremos. The whole of this sentence is compressed and obscure. In the first place, *extremos* must be very freely rendered, "who inhabit the confines of the world and liberty." Then *sinus famae* is not easily intelligible. "The hiding-place of their fame" is a close translation, but what is meant is that on account of their remote situation their fame had not reached the world.

KEY TO TACITUS (*continued*).

16. When with these and the like reasons they had aroused each other, they unanimously took arms. Boadicea, of royal descent, although a woman, led the revolt; for in conferring sovereignty, they make no distinction of sexes. They not only attacked the Roman garrisons scattered over the country, but having stormed the forts, even carried their arms into the Roman settlement, the seat of servitude; nor did rage combining with victory dispense with any kind of cruelty practised by barbarians. In truth, had not Paulinus, upon learning the revolt of the province, come with speed to its relief, Britain had been lost. Yet, by the success of a single battle, he restored the country to its previous state of submission; though several continued in arms, such namely as the consciousness of rebellion and the fear of the governor more particularly troubled. He, excellent as he was in all other respects, yet treated such as had surrendered with arrogance, and was as severe as if avenging his own injury. Therefore, Petronius Turpilianus was sent out as being more open to appeals, and as one who, being unacquainted with the delinquencies of the enemy, would be more gentle to their remorse. Turpilianus, when he had quite appeased the late commotions, ventured upon nothing further, and then delivered the province to Trebellius Maximus. He, still more inactive than his predecessors, and with no experience of active service, held the province by a certain complaisance in his administration. The barbarians had now likewise learnt to make allowance for attractive vices. Moreover, the civil wars which then intervened, furnished a proper excuse for inaction. But trouble was caused by mutiny; for soldiers inured to campaigns were through idleness grown turbulent. Trebellius, disgraced and humiliated because he escaped the wrath of the soldiers by running away and hiding, afterwards exercised authority on sufferance, as if there had been a bargain that the soldiers should keep their licence, the general his life. So in this mutiny no blood was spilled. Neither did Vettius Bolanus, as the civil war continued, worry Britain with discipline. Towards the enemy there still remained the same negligence; there was the same insubordination in the camp, only that Bolanus, an innocent man and odious for no sins, gained their affection instead of authority.

17. But when Vespasian had, with the possession of the rest of the world, also restored Britain to order, in it were seen great commanders, noble armies, and the hope of the enemy abated. Petilius Cerialis struck them at once with terror, by attacking the community of the Brigantes, reckoned the most populous of the whole province. There followed many encounters, such as on some occasions proved bloody. So that he either conquered or at least attacked most part of their country. In truth, though Cerialis would have eclipsed the vigilance and fame of any other successor, yet Julius Frontinus sustained the burden; and, a great man as far as was permitted, he by the sword subdued the powerful and warlike nation of the Silures, struggling against the difficulties of place as well as the valour of the enemy.

18. Such was the condition of Britain, such the fortune of the war which Agricola found upon his arrival about the middle of summer, when the soldiers, as though the campaign were over, were bent upon inaction, and the enemy were waiting an opportunity. The tribe of the Ordovices had not long before his coming slaughtered nearly a whole squadron serving upon their confines; and by that essay the province was excited, while those who wished for war commended the action as an example, and watched the spirit of the new legate. Meantime Agricola—though the summer was over, though the troops were dispersed over the province, though the fact that peace for that year had been taken for granted seemed likely to cause delay and difficulty to one about to begin war, and to most people it seemed better that suspected points should be watched—determined to meet the danger. Hence, having gathered together a band of veterans, with a small body of auxiliaries (as the Ordovices dared not descend into level ground), he, to inspire his men with equal courage against a common danger, marched in person in front of the ranks, and led his force uphill. Almost the whole tribe was cut off; but, well aware that it behoved him to maintain his success, and that with the issue of his first attempts all the rest would correspond, he conceived a design to reduce the Isle of Anglesey, a conquest from which Paulinus was recalled by the general revolt of Britain, as above I have recounted. But as this

counsel was premature, ships were found wanting; the capacity and firmness of the general managed the crossing. The chosen men of the auxiliaries, disencumbered of their baggage (such as were experienced in fords, and according to the usage of their country were dexterous in swimming, so as in the water at once to manage themselves, and their horses and arms), he caused to make an onset so sudden that the enemy were struck with consternation, as men who expected that if the Romans did attack, they would come by sea in ships, and now believed no enterprise difficult and insurmountable to such assailants. Thus they sued for peace, and even surrendered the island; and thence Agricola was already considered as a renowned and great commander; for that, at his first entrance into the province, a time which other governors are wont to waste in show, or in a round of duties, he preferred feats of labour and of peril. Nor did he apply his success to vain glory, or apply the title of campaign or of victory to the task of keeping subjects in check; nor did he set forth his exploits in a laurelled letter. But even by disguising his fame, he enlarged it; as men considered how vast must be his hope for the future when he said nothing of such great achievements.

19. For the rest, thoroughly acquainted with the temper of his province, and taught also by the experience of others that little is gained by arms where oppression follows, he determined to cut off all the causes of war. Beginning, therefore, with himself and his own, he kept his own household under restraint, a task which to many proves not less difficult than that of governing a province. By no freedmen or slaves was aught that concerned the public transacted. In choosing (for service) centurions and soldiers he was swayed by no personal interest, nor by anyone's recommendation and suit, but he ever thought that the best soldiers were the most trustworthy. All that passed he knew, but did not follow all things up. Upon small offences he bestowed pardon; for such as were great he exercised proportionate severity. He frequently was satisfied not with the punishment, but with remorse. In conferring offices and employments, he rather chose men who were not likely to transgress, than afterwards condemn transgressors. He softened the exaction of grain and the tribute by causing an equal distribution of public burdens; since he abolished whatever exactions had been devised for gain, and were therefore more grievously endured than the tribute itself. For the inhabitants were forced to bear the mockery of waiting at their closed barns, and of purchasing their own corn and bringing it up to a fictitious price. Long journeys and distant places were fixed upon for them, insomuch that the states, with winter-quarters near them, must carry corn to remote places and difficult of access, to the end that what was easy to be had by all might produce gain to a few.

20. By suppressing these grievances immediately in his first year, he gave back to peace her good report; peace which, either through the neglect or severity of his predecessors, was till then dreaded no less than war. But upon the coming of summer, he assembled his army, was often with his troops on the march, praised good conduct, and checked the stragglers. He himself chose the ground for encamping; he himself explored the firths and woods; and to the enemy, all the while, he permitted no peace, but was ever distressing them with sudden incursions. Then, having sufficiently alarmed them, would by sparing them display the allurements of peace. By this conduct, several communities, which till that day had been independent, laid aside hostility, gave hostages, and were begirt with garrisons and fortresses, with a just contrivance and a care, with which no newly conquered part of Britain had hitherto been treated.

21. The following winter passed undisturbed, and was employed in salutary measures. For, to the end that men scattered and uncivilised, and thence easily instigated to war, might by a taste of pleasures be reconciled to quiet and repose, Agricola privately exhorted them, then assisted them out of the public funds, to build temples, courts, and houses, praising the assiduous and reproving the lazy; so that an honourable rivalry was substituted for compulsion. He also gave the sons of the chiefs an education in the liberal arts and advanced the natural powers of the Britons beyond the industry of the Gauls; so that they who had so lately scorned the Roman language, were become fond of its eloquence. Thence they began to honour our apparel, and the toga was frequent. By degrees they proceeded to the incitements of vice—the portico, the bath, the sumptuous banquet. Nay, all this innovation was by the ignorant styled politeness, when it was indeed part of their bondage.

GREEK.—XI.

[*Continued from p.* 198.]

THE VERB—GENERAL EXPLANATIONS—THE SUBSTANTIVE VERB *εἰμί, I AM.*

If we examine the proposition *ὁ στρατιώτης ἐστὶν ἀγαθός*, *the soldier is good*, we shall see that it consists of three parts. Ὁ *στρατιώτης*, *the soldier*, is what is termed the *subject* of the proposition; that is, it is that of which something is asserted or declared. *Ἀγαθός*, *good*, is the *attribute*, or that quality which is asserted of the subject *soldier*. The word *ἐστίν*, *is*, which connects the subject and attribute together (hence called the *copula*), is the *Verb*, so named because it is the principal *word* in the proposition; without a verb there could be no proposition. Its essential function is to affirm or declare something of the subject; thus, here it affirms of the *soldier* that he is *good*. The term *predicate* is applied by some grammarians to the attribute alone; by others, to the copula and attribute together: thus—

Subject.	*Copula.*	*Predicate.*
ὁ στρατιώτης	*ἐστὶν*	*ἀγαθός.*

Or—

Subject.	*Predicate.*	
	Verb.	*Attribute.*
ὁ στρατιώτης	*ἐστὶν*	*ἀγαθός.*

Very often the verb forms by itself the predicate of a proposition, and contains both the copula and the attribute—that is, the verb by itself makes the affirmation: thus, *λύω*, *I loose*, where *loosing* is predicated or affirmed of the subject *I*. Here the subject is a pronoun; and since the person intended is marked by the termination of the verb (called the personal suffix), the subject is involved in and expressed by the word itself. Accordingly, in Greek, as in Latin, a verb may contain in itself the subject, the copula, and the predicate; in other words, it may comprise both predicate and subject.

VOICES.

(1)	λύω,	*I loose.*	Active.
(2)	λύομαι,	*I loose myself.*	Middle.
(3)	λύομαι,	*I am loosed.*	Passive.

Here we have a verb in three forms. The first form is called the *Active Voice*, the second form is called the *Middle Voice*, the third form is called the *Passive Voice*. In the active voice, the subject acts; in the passive voice, the subject is acted upon; in the middle voice, the action comes back upon the subject—that is, the subject is both acting and acted upon. It is called *middle* because it stands in sense midway between active and passive, partaking of the signification of both. These varieties, it will be noticed, are varieties in both form and meaning. Thus, λύω, the active, differs in form from λύομαι, the middle. It differs also in signification; for while λύω signifies *I loose*, λύομαι signifies *I loose myself.*

Verbs in the active voice are either *transitive* or *intransitive*. They are called transitive when the action passes on to, and acts upon, something which is called *the object*, as λύω τὸν ἄνδρα, *I loose the man*, where the object ἄνδρα is acted upon by the subject of λύω. In an intransitive verb the action does not pass on to an object, as θάλλω, *I bloom.* It is obvious that an intransitive verb can have no passive voice. Some intransitive verbs, however, are found with a middle voice, inasmuch as the middle does not always denote an action done *to* oneself (like τύπτομαι, *I strike myself*), but also an action done *for* oneself, as παρασκευάζομαι δεῖπνον, *I prepare a meal for myself;* and it is in this latter sense that some intransitive verbs may have a middle voice—*e.g.*, verbs in -εύω: as, βουλεύω, *I am a counsellor;* βουλεύομαι, *I am a counsellor for myself, I deliberate.*

In relation to numbers (2) and (3), as given above, it may be noticed that the English *I loose myself* and *I am loosed* are very nearly related in meaning. If I loose myself, clearly, I am loosed. The chief difference between the two is, that in the former the action is restricted to one person, namely, the subject; while, in the latter, it extends to a second person—the person, that is, by whom the subject is wrought upon. The difference, in consequence, is rather in the person than the act. Accordingly, the form remains the same, being in both cases λύομαι. Indeed, two forms are found only in the future and aorist tenses.

Very few, if any, verbs are known to possess all the tenses of the three voices, as they might be formed analogically. What forms really exist will appear as we proceed.

TENSES.

The *tense* is that modification of the verb which indicates the time of the action, whether past, present, or future.

The tenses are divided into two classes—*primary* or *principal*, and *secondary* or *historic.*

(i.) *Principal Tenses.*

(1) Present.	λύω, *I loose.*
(2) Future.	λύσω, *I shall loose.*
(3) Perfect.	λέλυκα, *I have loosed.*

(ii.) *Historic Tenses.*

(1) Imperfect.	ἔλυον, *I was loosing, I loosed.*
(2) Aorist.	ἔλυσα, *I loosed.*
(3) Pluperfect.	ἐλελύκη, *I had loosed.*

Each of the historic tenses is formed from its corresponding principal; thus:—

Tenses	Principal.	λύω.	λύσω.	λέλυκα.
	Historical.	ἔλυον.	ἔλυσα.	ἐλελύκη.

The exact manner of their formation will be explained by-and-by. At present observe that an action may be considered as now proceeding—the present tense; as proceeding in past time—the imperfect tense; as proceeding in time to come—the future tense; as actually done in past time—the aorist tense; as having proceeded in past time—the perfect tense; and as having proceeded previously to some other past act—the pluperfect tense. Accordingly, the present tense properly signifies, as in λύω, *I am loosing;* and the passive, λύομαι, *I am being loosed.* Mark, also, that the IMPERFECT denotes both an act going on in the past, and a continual and repeated act. The AORIST, as the word signifies, denotes an action as simply past, without any exact limitation, and so is called the indefinite (such is the meaning of the term) tense, or the tense of historical narrative. It is constantly used in Greek where we should use a pluperfect in English. The PERFECT denotes a past act which, in itself or in its consequences, comes down to or near the present time. The PLUPERFECT denotes an act done and past, when another past act was proceeding or was completed. Double forms are found of some of these tenses—viz., of the perfect, future (in the passive voice), and aorist (commonly distinguished as the first, or weak, and the second, or strong, aorist). A third future, or perfect passive future, is also found.

Only few verbs have both forms.

MOODS.

Mood is a grammatical term employed to point out the manner of an action. If we describe an act as simply taking place, we use—

(1) *The Indicative*—as λύω, *I loose,*

so called because it merely indicates or declares the act. This is the mood used, with a few exceptions, in independent statements.

If we describe an act as dependent on some other act, as dependent on a conjunction or a verb, we employ—

(2) *The Subjunctive*—as λύω, *I may loose.*

This is the mood of dependence, or of conception, so called because it implies dependence on another act expressed or understood; that is, an act really performed or conceived of in the mind.

(3) The *Optative* mood (λύοιμι) has two leading uses. (*a*) It expresses a simple wish, as λύοιμι, *may I loose;* hence its name, derived from opto, *I wish.* (*b*) In dependent sentences, when the act expressed in the principal sentence is in an historic tense, the optative supplies the place of the subjunctive in the dependent sentence: *e.g.*—

	Principal.		*Subjunctive.*	
	τοῦτο ποιῶ	ἵνα	λύω,	*I do this that I may loose.*
	Historic.		*Optative.*	
But,	τοῦτο ἐποίουν	ἵνα	λύοιμι,	*I did this that I might loose.*

If we express an act in the way of command, we use—

(4) *The Imperative*—as λῦε, *loose thou.*

These four moods are called *finite* (that is, definite or limited), because they all express the act under certain limitations or modifications.

But if we express an act indefinitely, or in its abstract form—disconnected, that is, from person or number—we then employ the mood termed

(5) *The Infinitive*—as λύειν, *to loose.*

Another modification of the verb is found in—

(6) *The Verbal Adjective*—λυτέος, *one who must be loosed,*

which resembles the Latin participle passive in -dus (as, amandus, *he must be loved*), and has a passive force.

THE PARTICIPLES.

Participles are so called because they partake of the qualities of the verb and the adjective. As expressive of the quality of the verb, they denote action; as expressive of the quality of the adjective, they denote modification. For example, βουλεύων ἀνήρ, *a counselling man* (that is, *a counsellor*).

PERSONS.

In Greek, as in English, there are three persons. 1st, the speaker (*I*); 2nd, the person spoken to (*thou*); 3rd, the person spoken of (*he*). The persons in Greek are in general indicated by personal endings—that is, changes in the termination of the verb: for example—

1st Person.	*2nd Person.*	*3rd Person.*
λύ-ω, I loose.	λύ-εις, thou loose*st.*	λύ-ει, he loose*s.*

In the English terminations, *-st*, *-s*, we have an example of these person-endings.

NUMBERS.

As in nouns, so in verbs, the Greek has three numbers—the ***singular***, the ***plural***, and the ***dual***. The singular number denotes one single object; the plural denotes more objects than one; and the dual denotes precisely two objects. The dual, however, is seldom used, unless it is required to specify the number two. The first person of the dual is supplied by the form of the first person plural.

CONJUGATIONS.

The term *conjugation* denotes peculiarities of formation in number, person, tense, mood, and voice. These peculiarities in Greek have been brought under two heads, and so two conjugations have arisen. These are (i.) verbs of which the first person singular ends in -ω (this class comprehends the great bulk of the Greek verbs); and (ii.) verbs of which the first person singular ends in -μι (these verbs are few in number, but—from their meaning—of very frequent occurrence): *e.g.*—

(i.) λύ-ω, *I loose.*
(ii.) ἵστη-μι, *I place.*

PREFIXES, SUFFIXES, AND STEMS.

The essential elements which make up the finite verb may be distinguished as stem, and personal suffixes. In the secondary tenses of the indicative there is also the prefix, called the augment: *e.g.*—

Augment.	*Stem.*	*Inflexion.*	
ε-	λυσ-	-α (originally -ν),	*I loosed.*

Moreover, there are mood suffixes, and also in some cases a euphonic vowel is inserted between the tense-stem and the personal suffix.

We must further distinguish the ***simple stem*** (which is the fundamental part of the verb, and is sometimes identical with the root) and the ***tense-stems*** (*i.e.*, those modifications of the simple stem which are seen in the various groups of tenses).

The simple stem of the verb may in most verbs be found by removing the augment and the personal ending of the second, or strong, aorist—*e.g.*, ἔ-λιπ-ον (second aorist of λείπω) shows λιπ- as the simple stem; and, again, in the first aorist of λύω, by dropping the personal-ending -α we get ἔλυσ-, of which form the ε- is the augment or prefix, the force of which is to denote past time. Remove this, and we have left the tense-stem of the first aorist active (λυσ-). This is formed by the addition of sigma (*s*) to the simple stem; and hence the first aorist is also known as the "sigmatic" aorist, though, as will be observed, in some cases the *s* is lost, and compensation made by vowel-changes in the stem. This is the case in all liquid stems: *e.g*, root μεν- gives as first aorist ἔ-μεν-σ-α, which appears as ἔ-μειν-α.

According to the general statements and explanations already set forth, the verb may be regarded as a total comprising a number of ideas or representing a number of facts. This may be exemplified in λείπω, *I leave*, and λειφθειήτην, *they two might have been left*. Thus:—

	Person.	*Number.*	*Tense.*	*Mood.*	*Voice.*
λείπω.	1st.	Singular.	Present.	Indic.	Active.
λειφθειήτην.	3rd.	Dual.	Aor. 1st.	Optat.	Passive.

From this instance it may be seen that the Greek verb varies, or is modified in person, in number, in tense, in mood, and in voice. Accordingly, it is the business of the learner to become familiar with the verb in all these its modifications, so as to at once recognise every form he may meet with in reading, and be ready at first sight to assign its meaning. It will be necessary to go through these modifications in detail.

Before we proceed to the general conjugation of the Greek verbs, we must present a peculiar form—namely, that of the substantive verb, or verb of existence, εἶναι, *to be*, with some parts of which the student is already familiar; and we must give at once the main rules for the accentuation of verbs.

ACCENTUATION OF VERBS.

We have already seen that the general principle for the accentuation of verbs is that they throw back the accent as far as possible—that is, place it as near the beginning of the word as the general rules summed up above allow.

It must also be remembered that participles, like adjectives, follow the laws that determine the accentuation of nouns; and that in compound verbs the accent can never precede the augment (*e.g.*, not ἄνειχον but ἀνεῖχον, not πάρησαν but παρῆσαν).

There are, however, a good many exceptions to this general principle, which must be carefully observed.

I. All active optatives third person singular in -οι and -αι are accented on the penultima (*i.e.*, are paroxytone, since -οι and -αι are counted as long in

II. The infinitives of the first aorist active, the second aorist middle, the perfect passive, and all infinitives in -ναι, are accented on the penultima (*i.e.*, either paroxytone or properispomenon, according to the length of the last syllable).

III. The second aorist infinitive active is always accented on the last syllable (perispomenon).

IV. The second aorist participle active, all active participles of verbs in -μι, and all in -εις and -ως, are oxytone.

V. The perfect passive participle is paroxytone.

VI. The imperative of the second aorist middle (second person singular) in -ου is perispomenon, with a few exceptions.

To these must also be added (though they are rather apparent than real exceptions) the circumflexed futures, the subjunctives of the passive aorists and of verbs in -μι (circumflex), and the optatives of verbs in -μι, with all other cases of contraction.

CONJUGATION OF THE VERB εἰμί, *I AM*.

INDICATIVE MOOD.

Singular.

PRESENT.	IMPERFECT.	FUTURE.
1. εἰμί, *I am.*	ἦν or ἦ, *I was.*	ἔσομαι, *I shall be.*
2. εἶ, *thou art.*	ἦσθα, *thou wast.*	ἔσῃ or -ει, *thou shalt be.*
3. ἐστί. *he is.*	ἦν, *he was.*	ἔσται, *he shall be.*

Dual.

2. ἔστον, *you two are.*	ἦτον, *you two were.*	ἔσεσθον, *you two shall be.*
3. ἔστον, *they two are.*	ἦτην, *they two were.*	ἔσεσθον, *they two shall be.*

Plural.

1. ἔσμεν, *we are.*	ἦμεν, *we were.*	ἐσόμεθα, *we shall be.*
2. ἔστε, *you are.*	ἦτε, *you were.*	ἔσεσθε, *you shall be.*
3. εἰσί, *they are.*	ἦσαν, *they were.*	ἔσονται, *they shall be.*

SUBJUNCTIVE MOOD.

PRESENT.

Sing. 1. ὦ, *I may be.*
2. ᾖς, *thou mayst be.*
3. ᾖ, *he may be.*
Dual. 2. ἦτον, *you two may be.*
3. ἦτον, *they two may be.*
Plur. 1. ὦμεν, *we may be.*
2. ἦτε, *you may be.*
3. ὦσι, *they may be.*

OPTATIVE MOOD.

	PRESENT.	FUTURE.*
Sing.	1. εἴην, *I might be.*	ἐσοίμην.
	2. εἴης, *thou mightst be.*	ἔσοιο.
	3. εἴη, *he might be.*	ἔσοιτο.
Dual.	2. (εἴητον) εἶτον, *you two might be.*	ἔσοισθον.
	3. (εἰήτην) εἴτην, *they two might be.*	ἐσοίσθην.

* *N.B.*—This tense of this mood is only used in Oratio Obliqua to represent the future indicative of Recta, the optative being the regular mood of Oratio Obliqua. Thus εἴη answers to ἐστί, and ἔσοιτο to ἔσται.

Plur.	1. (εἴημεν) εἶμεν, *we might be.*	ἐσοίμεθα.
	2. (εἴητε) εἶτε, *you might be.*	ἔσοισθε.
	3. (εἴησαν) εἶεν, *they might be.*	ἔσοιντο.

IMPERATIVE MOOD.

PRESENT.

Sing.	2. ἴσθι, *be thou.*	*Dual.*	2. ἔστον, *be ye two.*
	3. ἔστω, *let him be.*		3. ἔστων, *let them two be.*
Plur.	2. ἔστε, *be ye.*		
	3. ὄντων, *let them be.*		

INFINITIVE MOOD.

Present. εἶναι, *to be.*
Future. ἔσεσθαι, *to be about to be.*

PARTICIPLES.

	PRESENT.		FUTURE	
	Nom.	*Gen.*	*Nom.*	*Gen.*
Masc.	ὤν	ὄντος, *being.*	ἐσόμενος	-ου, *about to be*
Fem.	οὖσα	οὔσης.	ἐσομένη	-ης.
Neut.	ὄν	ὄντος.	ἐσόμενον	-ου.

It must be understood that the significations given in the paradigms, or examples of conjugation, are sometimes only approximately correct; for the exact meaning, the student must wait until he is familiar with the details of syntax which will follow.

The verb whose forms are given above belongs, it will be seen, to the class of the verbs in -μι. There is another verb, spelt in the same way, but distinguished from it by its accent, which will be given in its place under the verbs in -μι—namely, εἶμι, *I will go.*

The present subjunctive—namely, ὦ, ᾖς, ᾖ, etc.—shows the terminations of the subjunctive of all the verbs in -ω. The second and the third person singular have the iota subscript, as seen above.

Similarly, the optative forms, εἴην, εἴης, εἴη, show the terminations of the optative of the verbs in -μι.

The future, in all its moods, is a middle form; its termination, -σομαι, is that of all the middle verbs in the future. The original forms were—

ἔσομαι, ἔσεσαι, ἔσεται.

In ἔσεσαι the second σ was lost (as σ between two vowels, arising from inflexion, invariably is in Greek), and the word became ἔσεαι. The εα was contracted into η, the ι was written under, and thus ἔσῃ arose. This explanation applies to all the second persons in ῃ of the middle and passive verbs.

Ἔσται is a contracted form of ἔσεται. In the optative, ἔσοιο stands for ἔσοισο.

The participle ἐσόμενος (the Latin *futurus*) is declined like ἀγαθός, ἀγαθή, ἀγαθόν.

The substantive verb lacks the perfect, the pluperfect, and the aorist; these tenses are supplied from γίγνομαι, *I become.*

The stem of the verb is εσ-, as found in ἔσμεν, ἔσομαι, etc.

The present participle is declined thus:—

	Singular.			*Plural.*		
	MASC.	FEM.	NEUT.	MASC.	FEM.	NEUT.
Nom.	ὤν	οὖσα	ὄν.	ὄντες	οὖσαι	ὄντα.
Gen.	ὄντος	οὔσης	ὄντος.	ὄντων	οὐσῶν	ὄντων.
Dat.	ὄντι	οὔσῃ	ὄντι.	οὖσι	οὔσαις	οὖσι.
Acc.	ὄντα	οὖσαν	ὄν.	ὄντας	οὔσας	ὄντα.

So decline the participles in -ων of all the verbs.

By the aid of prepositions various compounds of εἰμί are formed, and these compounds are conjugated like their primitive: as, πάρ-ειμι (adsum), *I am present;* ἄπ-ειμι (absum), *I am absent;* μετ-ειμι (intersum), *I am among;* σύν-ειμι (una sum), *I am with;* πρόσ-ειμι (insum, accedo), *I am near, I approach;* περί-ειμι (supersum, superior sum), *I survive, I am superior;* and others. The preposition remains invariable; only the verb undergoes the conjugational changes.

The verb εἰμί is instructive in regard to the original personal endings. These personal endings in εἰμί are here marked off by a hyphen: thus, εἰ-μί.

	Singular.	*Dual.*	*Plural.*
1.	εἰ-μί.		ἔσ-μεν.
2.	ἔσ-σι(εἶ).	ἔσ-τον.	ἔσ-τε.
3.	ἐσ-τί(ν).	ἔσ-τον.	εἰ-σί(ν).

The terminations of the three persons of the singular are properly appended pronouns. Thus, -μι is found in με, -σι is found in σε, and -τι in the stem of the article τό. Accordingly, in their original form, these were—

THE PERSONAL TERMINATIONS.

		ACTIVE.		MIDDLE.	
		Principal Tenses	*Historical T.*	*Principal T.*	*Hist. T.*
Sing.	1.	-μι.	-ν.	-μαι.	-μην.
	2.	-σι.	-s.	-σαι.	-σο.
	3.	-τι.	—	-ται.	-το.
Dual.	1.	-μεν.		[-μεθον.]	
	2.	-τον.		-σθον.	
	3.	-τον.	-την.	-σθον.	-σθην.
Plur.	1.	-μεν.		-μεθα.	
	2.	-τε.		-σθε.	
	3.	-ντι.	-ν(ντ).	-νται.	-ντο.

By studying these terminations now, and by reverting to them afterwards, the student will be materially assisted; but he must make himself thoroughly master of all the paradigms before he attempts to set a step in advance.

VOCABULARY.

Ἀγορά, -ᾶς, ἡ, a market.
Ἄπορος, -α, -ον, impassable; τὰ ἄπορα, straits, extremities.
Ἄριστον, -ου, τό, breakfast.
Ἁρμόττειν, to fit, befit, suit, agree with.

Γεωργικός, -ή, -όν, agricultural. [Hence the name *Georgics*, given to Vergil's didactic poem on agriculture.]

Δύω, I go down, enter; *πρὸ δύντος ἡλίου*, before sunset.

Ἐπί, prep., with dat. = *in the power of.*

Ἐπιλείπω, I leave, lack; *ἐπέλιπε*, 3rd pers. sing. second aorist active, *failed.*

Θέλω, I desire, I will.

Νικάω, I conquer.

Ὁράω, I see, behold; *ὁρᾶν*, infinitive present active, *to behold ; ἔστιν ὁρᾶν*, lit. *it is to see*—that is, *you may see.*

Πρίαμαι, I purchase ; *πρίασθαι*, infinitive present middle, *to purchase ; οὐκ ἦν πρίασθαι*, lit. *was not to purchase*—that is, *could not be purchased.*

Συγκαλέω, I call together, convoke ; *ὁ συγκαλῶν*, convener.

Τάξις, -εως, ἡ, a rank or file of soldiers.

Φέρω, I bear.

Φυτεία, -ας, ἡ, planting, care.

Ὥρα, -ας, ἡ, an hour (Latin *hora*), time.

N.B.—The infinitive of verbs, with the neuter article, is used as a noun in Greek.

EXERCISE 64.

Translate into English :—

1. Ἡ τάξις ἦν ἑκατὸν ἄνδρες. 2. Ἦν τῆς ὥρας μικρὸν πρὸ δύντος ἡλίου. 3. Οἱ νόμοι ζημίαι εἰσὶ τῶν ἁμαρτωλῶν. 4. Τούτοις θάνατός ἐστιν ἡ ζημία. 5. Ὁ σῖτος ἐπέλιπε καὶ πρίασθαι οὐκ ἦν. 6. Ἔστιν ὁρᾶν τὸ ὄρος. 7. Ἡ Ἀγησιλάου ἀρετὴ παράδειγμα ἦν. 8. Ἡμῖν ἄριστον οὐκ ἔστιν. 9. Ἐγὼ ἔσομαι ὁ συγκαλῶν. 10. Οὗτός ἐστιν ὁ νικῶν. 11. Ἐγὼ μία τούτων εἰμι. 12. Βασιλεὺς νομίζει ὑμᾶς αὐτοῦ εἶναι. 13. Ἔστιν οὖν τῆς γεωργικῆς τέχνης ἡ τῶν δένδρων φυτεία. 14. Ἔστιν αὐτοῖς ἀγορά. 15. Ἐν τοῖς ἀπόροις ἦμεν. 16. Ὁ Κῦρος ἐν τούτοις ἦν. 17. Ἐπὶ σοὶ ἔσται τοῦτο. 18. Οὐ μικρὸν ἀγαθὸν τῷ ἁρμόττειν πρόσεστιν. 19. Τῇ βίᾳ πρόσεισιν ἔχθραι καὶ κίνδυνοι. 20. Τῇ ἐπιμελείᾳ περιεῖναι τῶν φίλων θέλω. 21. Παρῆν Ἀγεσίλαος δῶρα φέρων. 22. Κύρῳ παρῆσαν ἐκ Πελοποννήσου νῆες.

EXERCISE 65.

Translate into Greek :—

1. This is in my power. 2. The laws are in your power. 3. It is in your power to purchase corn. 4. It was in the power of the enemy to be present. 5. It is in the power of good boys to excel. 6. It will be in my power to approach the city. 7. Punishments belong (*πρόσειμι*) to sinners. 8. Thy care of thy friends is an example to all. 9. The ships have come to the king.

KEY TO EXERCISES.

Ex. 61. — 1. My father is good. 2. All men love their own fathers. 3. Your children learn their letters earnestly. 4. Your children are beautiful. 5. Your children are excellent. 6. We blame our own children. 7. Your friend is faithful. 8. My friend is faithless. 9. Your intellect governs your body. 10. My boy is diligent, but yours is not.

Ex. 62.—1. Σὸς πατήρ ἐστιν ἀγαθός. 2. Ὁ πατὴρ μοῦ ἐστιν ἀγαθός. 3. Ἡμῶν ὁ πατήρ ἐστιν ἀγαθός. 4. Σφέτεροι δοῦλοί εἰσι κακοί. 5. Ἡμέτεροι μὲν παῖδες σπουδαίως μανθάνουσι, ὑμέτεροι δέ εἰσιν ἄφρονες. 6. Ὁ φίλος σοῦ ἑαυτοῦ μὲν τὰ ἔργα θαυμάζει, οὐ δὲ τὰ τῶν ἄλλων.

Ex. 63.—1. This man is good. 2. This opinion is just. 3. This woman is beautiful. 4. That man is a king. 5. The king himself is general. 6. Take him the key, my boy. 7. Some people have not the same opinions about the same things on the same day. 8. Saying and doing are not the same. 9. These roses which bloom in the garden are beautiful. 10. A wise creature is man. 11. If you wish to win anyone's friendship, find out his character (his ways). 12. Who is writing this letter? 13. Tell me who is writing this letter? 14. Give a share to others of the things you have. 15. Happy is the man who has children. 16. Happiest is he who has no trouble. 17. What are you thinking about? 18. I do not say what I am thinking about. 19. Such as each man's character is, such is his life. 20. Who is that lady? 21. Tell me who that lady is.

ENGLISH LITERATURE.—IV.

[*Continued from p.* 207.]

CHAUCER AND HIS TIMES (*continued*).

THE versification of Chaucer has been the subject of much controversy. To a few his lines have seemed absolutely without metre, rhythm, or order of any kind; while others have perhaps run into an opposite extreme, and have represented his versification to be as regular as that of Pope or Goldsmith. The truth seems to be that, in general, Chaucer's versification is quite regular, the proper measure of syllables being found in the line and the proper number of accents. The seeming irregularity arises from not attending to the pronunciation of words in Chaucer's time. But, on the other hand, it is plain that Chaucer did allow himself far greater licence in the matter of metre than modern poets have done; and there are a large number of his lines in which, though a certain rhythm is preserved, the syllables will not bear counting. The main key to Chaucer's versification is to be found in what we have already explained—the sounding of the final *e*. It must also be remembered that many words of French origin, such as *courage, menace, liquour*, were not pronounced as we pronounce them, with a marked emphasis on the first syllable, *córurage, ménace, líquour*, but as in French, with both syllables equally emphasised, *córuráge, ménáce, liquóur.*

A thorough understanding of Chaucer's system of versification is of so much importance to anyone beginning to read his works, that we give here the first twelve lines of the Prologue to the "Canterbury Tales" as they are commonly printed, followed by a metrical arrangement of the same. Both the text and the metrical arrangement of it are taken from Mr. Bell's edition of Chaucer :—

"Whan[1] that Aprille, with his[2] showres swoote,[3]
The drought of Marche hath perced to the roote,
And bathud every veyne in swich licour,
Of which vertue engendred is the flour ;[4]
When Zephirus eek with his swete breeth
Enspirud hath in every holte and heeth
The tendre croppes, and the yonge[5] sonne
Hath in the Ram[6] his halfe cours i-ronne [7]
And smale fowles[8] maken[9] melodie,
That slepen alle night with open yhe,[10]
So priketh hem nature in here corages,[11]
Thanne longen folk to gon[12] on pilgrimages."

"Whăn that | Aprīl | lé, wīth | hīs schōw | rēs swoōte,
Thĕ drōught | ŏf Mārche | hăth per | céd tō | thĕ roōte,
Ănd bā | thŭd ēve | rў vēyne | ĭn swīch | līcōur,
Of whīch | vértuē | ĕngēn | drĕd is | thĕ flōur ;
Whăn Zē | phirūs, | eĕk wīth | hīs sweē | tĕ breeth
Enspī | rŭd hăth | ĭn ēve | rў hōlte | ănd hēeth
Thĕ tēn | drĕ crōp | pĕs, ānd | thĕ yōn | gĕ sōnne
Hăth ĭn | thĕ Rām | hīs hāl | fĕ coūrs | ī-rōnne,
Ănd smā | lĕ fōw | lĕs mā | kĕn mē | lōdiē,
Thăt slē | pĕn āl | lĕ night | wīth ō | pĕn ȳhe,
Sŏ prī | kĕth hēm | nătūre | ĭn hēre | cŏrāges,
Thánne lōn | gĕn fōlk | tŏ gon | ōn pīl | grĭmāges."

The most instructive classification of the writings of a great author is almost always that founded upon chronological order, for such an arrangement shows us not only the author's works, but the history of his mind as well. But the history of Chaucer's writings is so indefinitely ascertained that no chronological arrangement of them can be reliable. They may, however, usefully be grouped into certain classes, according to their general character. In the first place, we find a series of poems, some of them of considerable length, but by no means among the longest of Chaucer's poems, which distinctly belong, in subject, in form, and in treatment, to the school of the French romance-writers, who, as we have seen, had from the first supplied the literary appetite of the Normans in England. They are almost all dreams and allegories of love or kindred subjects. They are full of graceful fancy, ingenuity of invention, keen appreciation of the beauties of nature, and sweetness of versification ; but they do not show the higher and rarer qualities of Chaucer's genius. To this class belong "The Assembly of Fowls," and "The Book of the Duchess."

"The House of Fame" is a dream and an allegory, like the preceding poems, but an allegory of a very different class. The poet is borne by a golden eagle to the temple of Fame, where the goddess sits enthroned, and awards such measure of fame as she will to those who seek her honours, while the names of the great dead are inscribed in their appropriate places upon the temple. This scheme affords to Chaucer not only ample space for brilliant and impressive description, but for keen discrimination of the characteristics of those to whom he assigns a place in the temple ; while the injustice of the goddess's decrees admits of that satiric treatment of which Chaucer was a master. The general character of this poem can be gathered from Pope's modernised version of it, under the name of "The Temple of Fame."

The long poem of "Troilus and Cressida," and the series of tales published under the title of "The Legend of Good Women," are of a wholly different school. In them we find nothing of dream or allegory, nothing of the visionary unreality of the romance. The subjects, no doubt, are very remote from our own time or from Chaucer's, but the interest of the poem is purely human and natural. "Troilus and Cressida," though many of its principal characters are Homeric, is founded on a story wholly unknown to, and, indeed, quite out of harmony with, the notions of classical times. Chaucer, no doubt, derived the story from Boccaccio, just as Shakespeare afterwards borrowed it from Chaucer. "The Legend of Good Women" consists of a series of nine stories of women in ancient times famous for their constancy and devotion in love. It is said that this book is one of the very latest of Chaucer's works ; and there is internal evidence to support the view. There is also a tradition that the work was intended as a kind of apology to the fair sex to atone for any harshness with which he might have treated women in his earlier works.

And he has left us a separate work in prose, "The Testament of Love"—though there is a doubt as to the authorship—a work of no great importance in itself, but which has been the subject of much discussion, in consequence of an idea, probably without foundation, that the book contains, under an allegorical guise, the story of the author's own life. We also have a little book of instruction which he wrote for his son Lewis, called "Bread and Milk for Babes," or the "Conclusions of the Astrolabie," a simple treatise on the use of the astrolabe. There are many other shorter poems of Chaucer which our space does not allow us to examine; and it remains only to consider Chaucer's greatest work, the "Canterbury Tales."

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[1] When.

[2] *His* was used for *its* as well as for *his* ; *its* being of much later introduction.

[3] Sweet.

[4] In such moisture as to form the power (virtue) by which the flower is produced.

[5] Early.

[6] In the sign of the Ram.

[7] Past participle for *run*. The form has been already observed upon.

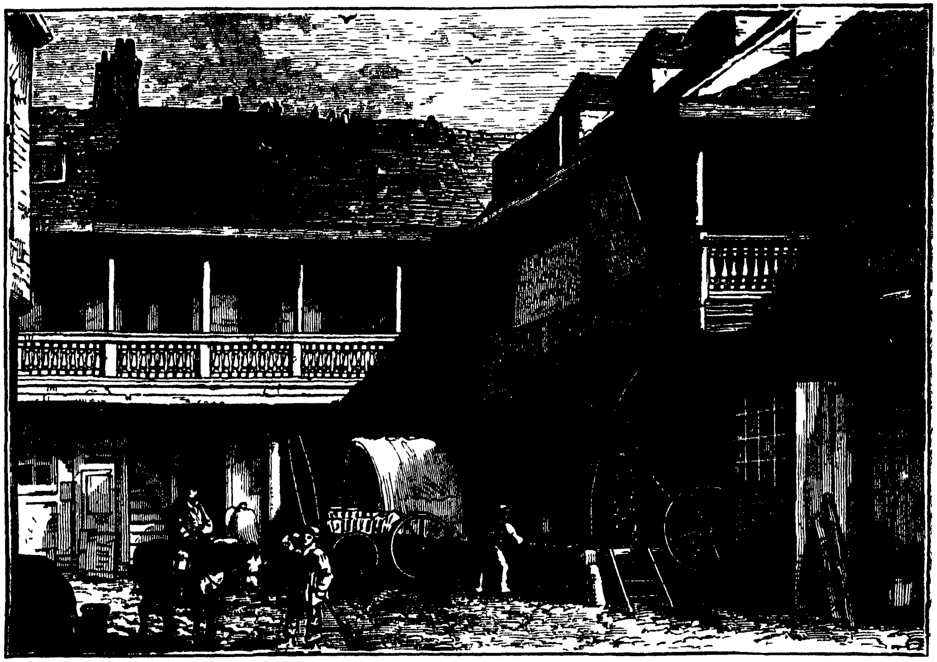
[8] Small birds.

[9] The third person plural of the present indicative, like *slepen* in the next line, and *longen*. The form has been already noticed.

[10] Eye.

[11] Nature so stimulates them in their passions. *He, hem, here,* are the usual forms in the English of Chaucer's day for *they, them, their.* Corages, from the French "*Cœur,*" heart ; here used in its early meaning of "disposition."

[12] It has already been said that the usual form of the infinitive is in *en*. Hence, by a natural contraction, the infinitive of *go* becomes *gon,* as in the text.



THE OLD TABARD INN. (*From a Sketch taken shortly before its demolition in* 1874.)

THE "CANTERBURY TALES."

We have reserved to the last the consideration of the "Canterbury Tales," probably the latest, and certainly by far the greatest and most interesting of Chaucer's works.

The general conception of this great work is, in one sense, not altogether original. Writers before Chaucer had done what many have done since, that is, had brought together a number of imaginary personages, more or less naturally grouped, and had placed a series of stories in the mouths of these characters; by this means giving a sort of continuity to what would otherwise be a collection of isolated stories, and thus securing a double interest for the whole work. Boccaccio, shortly before, had adopted this scheme in his "Decameron," in which he introduces a number of young ladies and gentlemen who have taken refuge in the same villa to escape the pestilence in Florence; and it is not improbable that the plan of the "Canterbury Tales" may have been to some extent suggested by the "Decameron"; though it is more likely still that this method of grouping was so familiar to the writers of Chaucer's day, and therefore suggested itself so naturally to his mind, that it could not be said to have been due to any one particular example. But, however this may be, it is clear that in the judgment with which Chaucer has selected his group of personages and the mode of bringing them together, the unequalled power with which he has given life to the individuals composing it, and the dramatic force with which he has conducted the action of the poem, this great work is in the highest and best sense original.

The poet begins by telling us that one night in spring, the season of pilgrimages, he found himself at the hostelry of the Tabard, in Southwark, ready to start on a pilgrimage to the shrine of St. Thomas à Becket at Canterbury. He finds there nine-and-twenty or thirty other persons bound upon the same pilgrimage with himself. The company is a most varied one. The first group we are introduced to consists of a knight, a young squire, his son, and a yeoman, his servant, going to perform the vow made by the knight, as we may gather, during his last foreign expedition. A prioress, Madame Eglantine, a very dignified lady, was also there, and in her train an attendant nun and three priests. Then there was a monk, a great man of his class, delighting in the chase and despising the restraints of monastic rule. The mendicant friar, again, is in an inferior rank a man of the same type, "a wanton and a merry." Of very different, but not less strongly-marked types are the sober and prudent merchant, the poor clerk or scholar from Oxford, the serjeant-at-law, and the franklin or country gentleman. Then there are the haberdasher, the carpenter, the webbe or weaver, the dyer, and tapiser or carpet-maker, the cook or keeper of a cook-shop, and the shipman or sea-captain. A doctor of physic is also of the party, and a wife of Bath—a well-to-do cloth manufacturer. In strong contrast with some of the preceding characters is the poor parson of a country parish, who is going on pilgrimage accompanied by his brother, a ploughman. The list is completed by a miller, a manciple or steward of some public institution, a reeve or bailiff, a sompnei or summoning officer of an ecclesiastical court, and a pardoner or seller of papal indulgences.

With this company, and the good cheer of the Tabard, the evening passes pleasantly; and at its close the host of the inn proposes that he should accompany his guests to Canterbury, acting as their guide upon the way; that, to shorten the road, each of the company should tell two stories on the journey to Canterbury, and two on the return journey; that he himself should act as arbiter among them, to whose decisions all should be bound to yield obedience; and that the most successful story-teller should be entertained at supper by the whole party on their return to the Tabard. This proposal is at once accepted The pilgrims start for Canterbury the following morning; and in accordance with their agreement they tell their tales, the order in which they relate them being decided by drawing lots. And the incidents of the journey and the tales of the travellers form the subject of the poem.

The special advantages of this plan are evident. No scheme could have enabled Chaucer to fill his canvas with a greater variety of characters, taken from all classes of society, and of all shades of opinion and temperament, or to have brought them together in a manner more natural and unstrained. No plan, in short, could have enabled him to give us a more complete and living picture of the life of his day. And the same thing enables him, without any appearance of incongruity, to give endless variety to his stories, suiting in each case the character of the story to the circumstances of the story-teller with admirable judgment. Had this plan been worked out in its entirety, the "Canterbury Tales," which, as it is, forms a long work, would have been one of the longest in the world; for we should not only have had the story of the journey to Canterbury, and the journey back, with probably the incidents of the stay at Canterbury, and the farewell supper to the teller of the best tale; but we should also have had more than 120 tales. But the work as we have it is manifestly incomplete. We have only twenty-four tales, and even this number is only reached by certain departures from the original plan. Of the pilgrims who started in company, the knight, the miller, the reeve, the cook,* the man of law, the wife of Bath, the friar, the sompnour, the clerk of Oxenford, the merchant, the squire, the franklin, the second nun, the doctor of physic, the pardoner, the shipman, the prioress, the monk, the nun's priest, the manciple, and the parson tell one tale each. Chaucer himself begins to tell the Tale of Sir Thopas, a dreary rhyming tale, intended as a burlesque upon the romances of

CHAUCER AS A CANTERBURY PILGRIM.
(*From the Ellesmere MS. of Chaucer.*)

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* The cook's tale is a mere fragment. A second cook's tale, printed in almost all editions of Chaucer—the "Tale of Gamelyn"—is probably not Chaucer's.

chivalry still common, as we have seen, in Chaucer's time. But he has not gone far when the host indignantly interrupts him, telling him he will have no more of such "drafty speche" and "rhyme doggerel"; whereupon the poet begins again, and tells in prose the moral tale of Melibæus and his wife Prudence. One of the existing tales, too, is told by one who is not among the company which started from the Tabard. During the journey the cavalcade is joined by a canon, an alchemist and a most unscrupulous rogue, and his yeoman or servant. And the yeoman tells a tale, in which he exposes the fraud and folly of his master so effectually, that the canon leaves the company as abruptly as he had joined it. The story, too, of the pilgrimage itself is as incomplete as the number of the tales. All that has come down to us—and no doubt all that was written has come down to us—is the general prologue, in which the pilgrims are described, the plans for the journey formed, and the start related; the twenty-four tales already mentioned; and short prologues or introductions to the several tales, containing detached portions of the history of the journey. But whether the tales are now preserved in the order in which their author would have finally retained them, and to what portions of the journey the various prologues refer, it is often impossible to decide. There is much reason to think that Chaucer, at his death, left what he had written very much in confusion, and that some other hand arranged the fragments.

The work naturally divides itself into two parts, the one dealing with the history of the pilgrims and the incidents of their journey, and consisting of the general prologue to the whole work, and the special prologues, or introductions by which the tales are connected together; the other consisting of the twenty-four tales told by the pilgrims.

The prologue is the most remarkable of all Chaucer's works, and one of the most remarkable in the whole range of literature. It consists, for the most part, of a series of masterly portraits of the pilgrims, every one of which is now, after an interval of nearly five hundred years, as fresh, as clear, and as vivid, as if it had been painted yesterday, Each one of them embodies the characteristics of the class of which it is the type so fully, that we feel convinced that we know what kind of men the monks, the lawyers, the doctors of Chaucer's day were; that we know, in fact, what our forefathers and their manner of life were like. Yet each one is also marked by individual traits belonging to the man, not to the class, which impress upon the mind that those we read of are no mere abstract representatives of classes, but real living men and women. Every student of literature ought to make himself thoroughly familiar with this prologue. All that we can do is to show Chaucer's manner of description by means of a few selected examples. The first portrait we choose is that of the prosperous monk or abbot. In this extract we alter the old spelling in some places:—

A monk there was, a fair for the maistrie,[1]
An out-rider, that loved venerye;[2]
A manly man, to be an abbot able.
Full many a dainty horse had he in stable;
And when he rode, men might his bridle hear
Jingle in a whistling wind so clear,
And eek[3] as loud as doth the chapel bell.
There as this lord was keeper of the cell,[4]
The rule of Saint Maure or of Saint Beneyt,[5]
Because that it was old and somedeal straight,[6]
This ilka monk let forby hem pace,[7]
And held after the newe world the space.[8]
He gaf not of that text a pulled hen,[9]
That saith, that hunters ben none holy men;
Ne that a monk, when he is cloisterless,
Is likened to a fish that is waterles;[10]
This is to say, a monk out of his cloistre,
But thilke text he held not worth an oyster;
And I saide his opinion was good.
What[11] should he study and make himselven wood,[12]
Upon a book in cloistre alway to pore,
Or swinke[13] with his handes, and labour,
As Austyn bit?[14] How shall the world be served?
Let Austyn have his swynk to him reserved.
Therefore he was a pricasour aright;[15]
Greyhounds he had as swift as fowl in flight;
Of prikyng and of hunting for the hare
Was all his lust,[16] for no cost wold he spare.
I saw his sleves purfiled at the hand[17]
With grys, and that the finest of a land;[18]
And for to fasten his hood under his chin,
He had of gold i-wrought a curious pin;
A love knot in the greater end there was.
His head was bald, and shone as any glass,
And eek his face as he had been anoynt;[19]
He was a lad full fat and in good point;[20]
His eyen steep,[21] and rolling in his head,

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[1] A fine-looking man, *for the mastery—i.e.*, above others.

[2] Hunting. [3] Even.

[4] Where this monk was superior of the monastery.

[5] St. Benedict. [6] Somewhat strict.

[7] Let them pass by. We still say, "Gave the go-by to."

[8] Followed the ways of the modern world.

[9] He gave not (would not give) a plucked fowl for—placed no value upon.

[10] It was an old and familiar saying that a monk out of his monastery was like a fish out of water.

[11] Why. [12] Mad. [13] Toil.

[14] As Austin bade—*i.e.*, according to the rule of St. Augustine.

[15] A thorough horseman.

[16] Pleasure, desire, will.

[17] Embroidered at the wrist.

[18] With fur, and that the finest in the land.

[19] As if he had been anointed.

[20] From the French *embonpoint*, plump.

[21] His eyes deep-set.

That steamed as a furnace of a lead ;[1]
His boots supple, his horse in great estate.
Now certainly he was a fair prelate ;
He was not pale as a forpined[2] ghost.
A fat swan loved he best of any roast.
His palfray was as brown as any berry.[3]

Our next extract, also taken from the prologue, is the character of the poor country parson, and the contrast between it and the picture of the luxurious monk will at once remind the reader of what has been said of Chaucer's sympathy with the party of Wiclif and his dislike of the monks :—

A good man was ther of religioun,
And was a pore parsoune of a toun ;[4]
But riche he was of holy thought and werk.
He was also a lerned man, a clerk
That Cristes Gospel gladly wolde preche ;
His parisschens[5] devoutly wolde he teche.
Benigne he was, and wonder[6] diligent,
And in adversite ful pacient ;
And such he was i-proved ofte sythes.[7]
Full loth were him[8] to curse for his tythes,[9]
But rather wolde he geven out of dowte,
Unto his pore parisschens aboute,
Of his offrynge, and eek of his substaunce.[10]
He could in litel thing han suffisance.[11]
Wide was his parisch, and houses fer asondur,
But he ne lafte not[12] for reyne ne thondur,
In siknesse ne in meschief to visite
The ferrest[13] in his parisch, moche and lite,[14]
Uppon his feet, and in his hand a staff.
This noble ensaumple unto his scheep he gaf,[15]
That first he wroughte and after that he taughte.
Out of the Gospel he the[16] wordes caughte,
And this figure he added yit therto,
That if golde ruste, what schulde iren doo?
For if a prest be foul, on whom we truste,
No wondur is a lewed man[17] to ruste ;
And schame it is, if that a prest take kepe,[18]
A schiten[19] scheppard and a clene schepe :
Wel oughte a prest ensample for to give,
By his clennesse, how that his scheep schulde live.
He sette not his benefice to huyre,[20]
And lefte his schepe encombred in the myre,
And ran to Londone, unto Seynte Paules,
To seeken him a chaunterie for soules,[21]
Or with a brotherhede be withholde ;[22]
But dwelte at hoom, and kepte well his folde,
So that the wolfe ne made it not myscarye.
He was a schepperde and no mercenarie ;
And though he holy were, and vertuous,
He was to sinful men nought dispitous.[23]
Ne of his speche daungerous ne digne,[24]
But in his teching discret and benigne.
To drawe folk to heven by fairnesse,
By good ensample, was his busynesse :
But it were any person obstinat,
What so[25] he were of high or lowe estat,
Him wolde he snybbe[26] scharply for the nones.[27]
A bettre preest I trowe ther nowher non is.
He wayted after no pompe ne reverence,
Ne maked him a spiced conscience,[28]
But Cristes lore, and his apostles twelve,
He taught, and first he fol[o]wed it himselve.

The short passages of narrative which occur under the title of prologues between the various tales are scarcely inferior to the general prologue in dramatic skill. The most noteworthy character in them is the good-humoured host, with his ready mother-wit, managing the somewhat troublesome pilgrims.

FRENCH.—XXXV.

[*Continued from p.* 213.]

FRENCH AND ENGLISH WORDS WHICH ARE SIMILAR IN FORM BUT DIFFER IN MEANING (*continued*).

English Words.	French Equivalents.	French Words.	English Equivalents.
Pie, *n.*	(*of meat*) *pâté* ; (*of fruit*) *tourte* ; (ornith.) *pie* ; (print.) *pâte*, *pâte*.	**Pie,** *nf.*, *adj.*	*magpie* ; *pious*, *charitable.*
Pile,	*pile* ; *tas*, *monceau* ; (*of muskets*) *faisceau* ; (building) *construction*, *édifice*, *bâtiment* ; (*of shot*) *pile* ; (arch.) *pieu*, *pilotis* ; (*of cloth*, *velvet*) *poil* ; (phys.) *pile* ; (*funeral pile*) *bûcher* ; (*of medals*, *coins*) *pile.*	**Pile,**	*pile*, *heap* ; *pier* (*of a bridge*) ; *mole* (*in building*) ; (arch.) *tambour* ; (phys.) *pile* ; (*of weights*) *pile* ; (her.) *pile* ; (*of medals*, *coins*) *pile.*

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[1] Like a lead furnace. [2] Wasted away.

[3] This last line illustrates a peculiarity of Chaucer's versification, which ought to be noted. Modern poets, writing in this metre, almost invariably end each paragraph with the second line of a couplet. Chaucer generally ends the paragraph with the first line of the couplet, making the end of one paragraph rhyme with the beginning of the next, and so connecting the two to the ear. Thus, it will be observed, the last line in the description of the monk ends with "berry" ; the next paragraph, introducing another personage, begins, "A frere there was, a wanton and a merry."

[4] A poor parson of a townland or rural parish.

[5] Parishioners. [6] Wonderfully. [7] Oftentimes.

[8] Very disagreeable would it be to him.

[9] To excommunicate for non-payment of tithes.

[10] Both of what he had received in voluntary offerings and of his property, that is, his benefice.

[11] Have sufficient. *Han* contracted from *haven*, infinitive of *have*.

[12] He omitted not. [16] Those.

[13] Furthest. [17] Layman.

[14] Great and small. [18] Take note of it.

[15] Gave. [19] Foul, dirty.

[20] Did not place a hired substitute in his benefice. The abuses among the clergy referred to in these lines are the constant theme of the satirists of the period.

[21] An endowment for saying masses for the soul of the giver of the endowment in St. Paul's Cathedral.

[22] To be maintained in a monastic brotherhood.

[23] Not uncharitable, not pitiless to the sins of others.

[24] Harsh or proud. [25] Whether. [26] Snub, rebuke.

[27] On that occasion, then and there.

[28] Did not spoil the natural simplicity of his conscience.

English Words.	French Equivalents.	French Words.	English Equivalents.
to Pile,	*entasser, empiler, amonceler;* (military) *mettre en faisceaux; piloter, enfoncer des pieux.*	**Piler,** *v.*	*to pound.*
Pin,	*epingle; cheville, esse, clavette, fiche;* (*of a pulley*) *essieu; fétu rien*	**Pin,**	*pine-tree.*
to Plan,	*tracer un plan, projeter.*	**Planer,**	*to planish, to make smooth, to plane.*
Plant,	*plante, plant; materiel* (*fixtures and tools for mechanical business*).	**Plant,** *nm.*	*set, twig; plant, young plant, sapling, slip; plantation, nursery.*
to Plant,	*planter; fonder, etablir, poser, placer;* (artil.) *pointer, braquer.*		
Plum,	*prune.*	**Plume,**	*pen; feather; quill.*
Pope,	*Pape; pope* (*priest of the Greek Church*).	**Pope,**	*priest* (*of the Greek Church*).
Porter, *n.*	*portier, concierge, porteur, commissionnaire, crocheteur, portefaix;* (*liquor*) *porter.*	**Porter,** *v.*	*to carry; to bear; to wear; to convey; to yield, to produce; to induce, to prompt; to excite; to import; to contain.*
Poster, *n.*	*courrier; affiche.*	**Poster,** *v.*	*to station, to place, to post.*
to Pour, *v.*	*verser, repandre, couler; se precipiter; pleuvoir a verse.*	**Pour,** *prep*	*for, in order to.*
Prejudice,	*prevention; préjuge;* (*in jury*) *prejudice, tort, dommage.*		
to Prejudice,	*prevenir; inspirer des preventions, des prejuges; faire tort a, nuire a, porter prejudice.*	**Prejudice,** *n.*	*hurt, detriment, injury, prejudice* (*harm*).
Premises,	*local; lieux; etablissement;* (jur.) *intitule;* (log.) *premisses*	**Prémisses,**	(log.) *premises.*
Preparer, *n.*	*appréteur; preparateur.*	**Préparer,** *v.*	*to prepare, to fit, to provide;* (agri.) *to till.*
Prime, *adj., n.*	*principal, premier; de premier ordre; de premiere qualite; precoce;* (arith.) *premier; aurore, aube; commencement; printemps; fleur, elite;* (Cath. relig.) *prime; beaute, force, fraicheur.*	**Prime,** *nf.*	*premium, bounty;* (Cath. relig.) *prime;* (fenc.) *prime;* (*cards*) *primers;* (com.) *prime wool;* (jewel.) *pebble; agio;* (customs) *drawback.*
to Prime, *v.*	*amorcer* (*a gun, a musket*); (paint.) *imprimer; servir d'amorce.*		

English Words.	French Equivalents.	French Words.	English Equivalents.
Primer, *n.*	*premier livre de lecture;* (Cath. relig.) *livre d'heures, heures canoniales;* (print.) *romain;* (milit.) *épinglette.*	**Primer,** *v.*	*to play first, to lead* (*at cards*); *to take the lead; to excel, to surpass.*
Property,	*propriété, biens.*	**Propreté,**	*cleanliness, neatness.*
Propriety,	*convenance, convenances, bienseance.*	**Propriéte,**	*property; ownership.*
to Prune, *v.*	*elaguer, tailler, emonder; rogner; arranger, ajuster;* (jest.) *s'ajuster, s'attiffer.*	**Prune,** *nf.*	*plum.*
Prune, *n.*	*pruneau, prune seche.*		
Rent, *pp.*	*dechiré.*		
to Rent, *v.*	*louer, donner a loyer, a ferme;* (*to take*) *louer, prendre a loyer, a ferme.*	**Rente,** *nf.*	*yearly income; revenue, annuity, pension; stock, funds.*
Rent, *n.*	*dechirement; dechirure; fente; accroc; schisme; fissure*		
Report, *n.*	*rapport; compte-rendu, rumeur, oui-dire; on dit, recit; reputation; detonation;* (law) *procès-verbal, rapport.*	**Report,** *nm.*	(*book-keeping*) *carrying over; sum carried over;* (*exchange language*) *to make a continuation.*
to Report, *v.*	*rapporter, raconter, dire; faire un rapport.*		
Resort, *n.*	*recours; fréquentation; concours; affluence; assemblee; rendez-vous;* (jur.) *ressort.*	**Ressort,** *nm.*	*spring; elasticity, energy, activity, force, means; extent of jurisdiction, department, province;* (law) *resort.*
to Resort, *v.*	*recourir, avoir recours a; aller; frequenter.*		
Rest, *n.*	(*remainder*) *reste, restant; repos; appui;* (mus.) *pause;* (*of a lance*) *arrêt; support.*	**Reste,** *nm.*	*rest, remainder; remnant; remains, residue;* (pl.) *mortal remains.*
to Rest, *v.*	*se reposer; reposer; dormir; s'appuyer, s'arrêter; se fier; s'en tenir;* (*to remain*) *demeurer, rester.*	**Rester,** *v.*	*to remain; to be left; to stay, to stop;* (mus.) *to hold;* (nav.) *to bear.*
to Resume, *v.*	*reprendre, recommencer; renouer; continuer.*	**Résumer,**	*to recapitulate; to sum up.*
Revolter, *n.*	*revolte, rebelle.*	**Révolter,** *v.*	*to cause to revolt or rebel; to stir up, to rouse; to shock, to be revolting to.*
Ride, *n.*	*promenade à cheval, en voiture;* (*in a cab, omnibus, etc.*) *course;* (*place*) *promenade.*	**Ride,** *nf.*	*wrinkle; ripple* (*of water*); (nav.) *laniard.*

English Words.	French Equivalents.	French Words.	English Equivalents.
to **Ride**, *v.*	*se promener à cheval, en voiture ; monter a cheval, étre a cheval en voiture ;* (print.) *chevaucher ; flotter, voguer.*	**Rider**, *v.*	*to wrinkle ; to shrivel ;* (*of water*) *to ripple ; to corrugate.*
Rocker, *n.*	*berceur, berceuse ; bascule.*	**Roquer**, *v.*	*to castle, to rook* (chess).
Roman, *n.*	*Romain ;* (print.) *romain.*	**Roman**, *adj., n.*	*Romanic, Romance (language); novel ; romance ; tale.*
Romance, *n.*	*roman, fiction.*	**Romance**, *nf.*	(mus.) *ballad.*
Rot, *n.*	*pourriture ; clavelée, claveau.*	**Rôt**,	*roasted meat, roast.*
Rout, *n.*	*réunion nombreuse, rout ; foule, multitude ;* (milit.) *déroute.*	**Route**, *nf.*	*road, horseway, route ; course* (nav.) *track ;* (*of planets*) *path.*
to **Rue**, *v.*	*se repentir ; regretter.*		
Rue, *n.*	(bot.) *rue ; chagrin, repentir.*	**Rue**, *nf.*	*street ;* (bot.) *rue.*
Sable, *n., adj.*	*martre zibeline .* (her.) *sable . vetement de deuil. Noir, sombre ; de deuil.*	**Sable**, *nm.*	*sand ; gravel ;* ((her.) *sable.*
		Sale, *adj.*	*dirty, nasty, foul; filthy, low, coarse.*
Sale, *n.*	*vente, débit.*	**Salle**, *nf.*	*hall ; large room ;* (*in hospitals*) *ward ;* (thea.) *house.*
Salve, *n.*	*onguent, remede, baume, pommade.*		
to **Salve**, *v.*	*guérir, avec des onguents ; remédier à ; secourir.*	**Salve**, *nf.*	(artil.) *salute, volley, salvo.*
to **Scorch**, *v.*	*roussir, brûler, rôtir.*	**Écorcher**, *v.*	*to flay, to skin ; to gall, to peel off ; to rub off the bark ; to take off the skin ; to fleece.*
Scythe, *n.*	*faux.*	**Scythe**, *n.*	*Scythian.*
Sentence,	(gram.) *phrase, periode;* (*maxim*) *maxime, sentence ;* (law) *jugement, sentence.*	**Sentence**,	*sentence (maxim); judgment; decree.*
Servant,	*serviteur, servante, bonne, domestique.*	**Servant**,	(artil.) *gunner.*
Sink, *n.*	*évier ; cloaque, égout ;* (print.) *tremperie.*	**Cinq**, *adj.*	*five.*
Solicitor,	*solliciteur ;* (jur.) *avoué.*	**Solliciteur**,	*one who solicits, solicitor ; canvasser.*
Son, *n.*	*fils.*	**Son**, *nm., adj.*	*sound ; bran ; his, her, its.*
Sort,	*sorte, genre, espèce ; manière, façon ; classe, condition ; paire.*	**Sort**,	*fate, destiny, lot ; spell, charm.*
to **Sort**,	*classer, distribuer ; trier, assortir ; appareiller* (cards).		
Sot,	*sot, imbécile, béte ; ivrogne.*	**Sot**,	*fool, simpleton, idiot.*
Soul,	*âme.*	**Soûl**, *nm., adj.*	*one's fill, one's bellyful ; glutted, surfeited, drunk ; cloyed, satiated.*

English Words.	French Equivalents.	French Words.	English Equivalents.
Sour, *adj.*	*aigre, sûr, acide ;* (fig.) *aigre, âpre, morose.*		
to **Sour**, *v.*	*aigrir ; acidifier ;* (fig.) *aigrir, empoisonner ; s'aigrir.*	**Sourd**, *n., adj.*	*deaf; deaf man.*
Stage,	*estrade ; scène, thеâtre ; degré, période, phase ; relai ; établi ; treteaux ; échafaud, plancher ; diligence (coach).*	**Stage**,	*probation, time of probation of a licentiate in law before he can be called to the bar ; also of medical students and others before they can begin to practise ; time of residence required of a new canon before enjoying the advantages attached to his prebend.*
Stationer, *n.*	*papetier.*	**Stationner**, *v.*	*to stop, to stay ; to stand (of carriages, hackney-cabs, etc.).*
Store,	*provision, quantité, abondance ; magasin, dépôt, arsenal ;* (fig.) *fonds, trésor.*	**Store**, *nm.*	*window blind, spring-roller blind.*
to **Store**, *v.*	*pourvoir, munir, approvisioner;*(fig.)*enrichir, orner.*		
Suit, *n.*	*collection ; assortiment ;* (cards) *couleur ; sollicitation, demande ; pétition, requête ; recherche en mariage, cour ; poursuite, procès.*	**Suite**, *nf.*	*remainder ; retinue, train, attendance; sequel, consequence, result.*
to **Suit**, *v.*	*adapter, approprier ; convenir, aller à ; plaire; revétir; s'accorder.*		
Tape, *n.*	*ruban de fil, de coton.*	**Tape**, *nf.*	*rap, slap, thump;* (nav.) *tompion.*
Taper, *n.*	*cierge ; petite bougie.*	**Taper**, *v.*	*to hit, to strike, to slap ; to frizzle (the hair) ; to sketch freely ;* (nav.) *to put a tompion in a gun.*
to **Taper**, *v.*	*finir en pointe, effiler ; se terminer en pointe, s'effiler.*		
Tar, *n.*	*goudron ; matelot, loup de mer.*	**Tard**,	*late.*
to **Tar**, *v.*	*goudronner.*		
Tenant, *n.*	*locataire ; habitant ; fermier.*	**Tenant**, *nm.*	*challenger ; supporter of an opinion ; defender of anyone ; one who frequents a house and acts like the master ;* (plur.) *adjacent lands, houses.*

English Words.	French Equivalents.	French Words.	English Equivalents.
Tenter, *n.*	*crochet; séchoir.*	**Tenter,** *v.*	*to attempt, to try, to tempt.*
to Tenter, *v.*	*ramer* (cloth), *s'etendre.*		
Test, *n.*	*epreuve; criterium; distinction; reactif;* (cupel) *test, têt;* (hist.) *test.*	**Test,** *nm.*	*test* (Engl. hist., metal.); *shell* (mol.).
to Test, *v.*	*eprouver; faire epreuve;* (metal.), *coupeller.*		
Timber, *n.*	*bois de haute futaie; bois de charpente;*(nav.) *couple, membre.*	**Timbre,**	*bell, clock-bell; ring, sound of a bell; tone of voice; stamp on paper;* (her.) *helmet;* (post-office) *mark; stamp; head, brains.*
Toil, *n.*	*peine. travail fatigant;* (net) *filet, ret.*	**Toile,** *nf.*	*linen cloth.*
to Toil, *v.*	*travailler fort; fatiguer.*		
Ton,	*tonne* (weight = 20 cwt.); (fashion) *ton.*	**Ton,** *nm., adj.*	*tone, tune, voice, accent, manner; strain, style, taste. Thy.*
Track, *n.*	*trace, voie, piste;* (of a comet) *route;* (of a ship) *sillage, eaux; sentier;* (fig.) *route, chemin, orniere.*	**Traquer,** *v.*	(hunt.) *to beat* (*for game*); *to enclose* (*a wood, game*); *to encircle, to ferret out.*
to Track, *v.*	*suivre à la piste, a la trace;* (to tow) *haler, remorquer.*		
Train,	*suite, cortége; suite, série, consequence, enchaînement, cours; marche; traînee* (of gunpowder); (of a dress) *queue;* (artil.) *train;* (of boats) *train;* (railways) *convoi, train; artifice.*	**Train,** *nm.*	*pace, rate, attendants; noise; skeleton* (of carriages); *quarters* (*of horses*); *train* (*of boats*); (print.) *carriage; raft;* (railways) *train;* (artil.) *train.*
to Train,	*dresser, former, exercer; élever, instruire; traîner; entraîner, séduire.*		
Trainer, *n.*	*eleveur; instructeur; celui qui dresse.*	**Traîner,** *v.*	*to draw, to drag; to trail; to put off; to spin out; to drawl.*
Traitor,	*traître.*	**Traiteur,**	*eating-house; eating-house keeper.*
Translation,	*traduction;* (removal) *translation, deplacement; version.*	**Translation,**	*translation* (*of bishops*); *removal* (*of parliament, government*); *postponement* (*of a ceremony*); (jur.) *transfer.*
Travel,	*voyage.*	**Travail,**	*labour, work, toil; piece of work; employment, study; travail.*

English Words.	French Equivalents.	French Words.	English Equivalents.
to Travel,	*voyager.*	**Travailler,**	*to labour, to work; fermenter* (*of wine*); *to study; to overwork* (*a horse*).
Trespass, *n.*	*injure; violation de propriété; delit contre la personne; offense, péche, transgression.*	**Trépasser,** *v.*	*to die, to depart this life.*
to Trespass, *v.*	*violer la propriété; pécher, faillir.*		
Tromp,	*machine soufflante.*	**Trompe,**	*horn, trumpet; proboscis, trunk* (*of elephants, insects, etc.*); *overhanging* (arch.); *Fallopian tubes.*
Trouble,	*peine, inquiétude, affliction, souci, chagrin, importunité, tracasserie, ennui.*	**Trouble,**	*confusion, disorder, disturbance, dispute, quarrel;* (pl.) *troubles, broils, commotions.*
Trumpery,	*éclat trompeur, faux brillant; rebut, friperie.*	**Tromperie,**	*deception, cheating, deceit, imposition.*
Tutor,	*precepteur, instituteur; professeur, maître.*	**Tuteur,**	*guardian* (*of minors*); *prop.*
Umbrella,	*parapluie.*	**Ombrelle,**	*parasol, sunshade.*
to Use,	*faire usage de; se servir de; user de, employer; user, consommer; accoutumer, habituer; en user, agir.*	**User,** *v.*	*to use, to make use, to consume, to wear out, to wear off; to spend, to waste.*
Valuable, *adj.*	*precieux.*	**Valable,** *adj.*	*valid.*
Vent, *n.*	*issue, ouverture, passage; lumière* (*of a gun*); *trou de fausset* (*in a cask*); *publication; articulation; carriere; cours, libre cours; vente.*	**Vent,** *nm.*	*wind, gale; flatulence; breath; scent* (hunt.); *vanity; emptiness;* (artil.) *windage.*
to Vent, *v.*	*donner issue, carriere a, cours a, un libre cours a, exhaler.*	**Venter,** *v.*	*to blow* (*of the wind*).
Venter, *n.*	*ventre, abdomen.*		
Venue, *n.*	(jur.) *voisinage.*	**Venue,** *nf.*	*coming, arrival, growth.*
Verge, *n.*	*verge;* (jur.) *ressort;* (gard.) *bord, bordure;* (*brink*) *bord, extrémité;* (*of a forest*) *lisière.*	**Verge,** *nf.*	*rod; shank* (*of an anchor*); *handle* (*of a whip*); (pl.) *rod, birch.*
to Verge, *v.*	*pencher; approcher.*		
Verger, *n.*	*huissier à verge; porte-verge.*	**Verger,** *nm.*	*orchard, fruit-garden.*
Versant, *adj.*	*familier.*	**Versant,** *nm., adj.*	*declivity, side, slope* (*of mountains*); *liable to overturn* (*of carriages*).

English Words.	French Equivalents.	French Words.	English Equivalents.
Verser, *nm.*	*versificateur.*	**Verser**, *v.*	*to shed ; to spill ; to pour ; to be overturned (carriages); to deposit (money).*
to **Vie**,	*rivaliser, lutter, disputer.*	**Vie**, *nf.*	*life.*
Viol,	(mus.) *viole.*	**Viol**, *nm.*	*violation (of the person) ; rape.*
Voyage,	*voyage par mer ; traversée.*	**Voyage**,	*travel by land ; voyage by sea.*
to **Voyage**,	*voyager par mer ; traverser, parcourir.*	**Voyager**,	*to journey by land, or by water.*

TRANSLATION FROM FRENCH.

Mlle. de Lajolais.

La galerie que devait traverser l'Empereur, pour se rendre au conseil, était une vaste pièce longue, éclairée par des croisées parallèles, les unes ayant vue sur la cour d'entrée, les autres sur les jardins. Neuf heures venaient de sonner, et peu à peu les deux côtés de cette galerie se remplirent de monde, de curieux, de solliciteurs, des officiers de service, des gens de la maison. Parmi tout ce monde deux femmes se faisaient remarquer, la première par sa beauté, et l'air gracieux avec lequel elle accueillait les saluts respectueux de tous ceux qui passaient près d'elle ; et la seconde par son extrême jeunesse, par la pâleur qui donnait à sa beauté un caractère extraordinaire, et par ses beaux cheveux blonds tombant en boucles nombreuses sur ses épaules.

"Allons, du courage!" disait la première à la seconde, "du courage!"

"Je ne vous quitterai pas," disait encore la première. Puis, pour donner plus de poids à ses paroles, sa main allait chercher la main de la jeune fille et la serrait avec amitié.

Le regard le plus expressif et le plus triste répondait à cette faveur ; et incontinent les beaux yeux de l'enfant se retournaient vers la porte par laquelle devait paraitre l'Empereur. Toute cette âme jeune, aimante, exaltée, semblait avoir passé dans ses yeux ; tout le reste de son corps paraissait inanimé.

Deux heures se passèrent ainsi ; deux heures d'attente, de peines, d'angoisses, et, pendant ces deux heures, ni l'une ni l'autre de ces enfants n'avait bougé.

La plus jeune, tenant les yeux attachés sur cette porte fermée, attendait qu'elle s'ouvrît pour respirer, pour vivre ; l'autre ne détournait pas les yeux de dessus sa compagne. Le plus profond silence régnait dans cette galerie ; on n'entendait que la respiration plus ou moins agitée de tout ce monde qui attendait aussi.

Enfin onze heures sonnent, les deux battants de la porte s'ouvrent, et un huissier annonce l'Empereur.

Plusieurs personnes paraissent à la fois.

"Lequel?" demande Maria dans la plus vive anxiété.

"Le seul qui ait son chapeau sur la tête," lui répond vivement Hortense.

La jeune fille n'en écoute pas davantage; ne voyant plus qu'un seul être dans toute cette foule qui l'environnait, elle sort des rangs, s'élance aux pieds de celui qu'on lui a désigné, s'écrie : "Grâce ! grâce !" et joint les mains avec force en les levant vers le ciel.

À ces cris, à cette action imprévue, l'Empereur s'arrête en fronçant les sourcils.

"Encore!" s'écrie-t-il d'un ton d'impatience, "j'avais pourtant dit que je ne voulais plus de ces scènes-là!"

Et croisant ses bras sur sa poitrine, il voulut passer outre.

"Sire!" cria la jeune fille, à laquelle la position de son père donnait une énergie au-dessus de son âge, "je vous en conjure, écoutez-moi ! Au nom de votre mère, Sire, écoutez-moi ! au nom de votre père, accordez-moi la grâce du mien ! C'est mon père, Sire ; il aura été entraîné, séduit ; pardonnez-lui ! Oh ! Sire, vous tenez la vie de mon père, la mienne dans vos mains. Ayez pitié d'une malheureuse enfant qui vous demande la vie de son père. Sire! Sire ! grâce . . . pitié . . . pardon."

"Laissez-moi, mademoiselle," dit l'Empereur, la repoussant assez rudement.

Mais, sans se laisser intimider (il y allait d'une existence trop chère), Mlle. de Lajolais, se traînant sur les dalles de marbre de la galerie, criait avec angoisse—

"Oh ! pitié, pitié, Sire ! . . . grâce ! . . . pour mon père ! Oh ! jetez au moins un regard sur moi, Sire !"

Il y avait quelque chose de si déchirant dans cette voix d'enfant demandant la vie de son père, que l'Empereur s'arrêta malgré lui, et regarda celle qui l'implorait avec tant d'instance.

Mlle. de Lajolais était fort bien, mais, dans ce moment, sa beauté tenait de l'ange. Blanche comme un cygne, la douleur donnait à ses traits un caractère énergique et passionné ; ses beaux cheveux blonds ruisselaient sur ses épaules ; ses petites mains, crispées par la fièvre, avaient fini par saisir une des mains de l'Empereur, et lui communiquaient leur chaleur brûlante. Agenouillée, le visage baigné de larmes, levant ses grands yeux bleus vers celui duquel elle semblait attendre la vie ou la mort, elle ne pouvait plus ni parler, ni pleurer, ni respirer.

"N'êtes-vous pas Mlle. de Lajolais?" lui demanda l'Empereur.

Sans répondre, Maria pressa la main de l'Empereur avec plus de force.

Il reprit avec sévérité, "Savez-vous que c'est la seconde fois que votre père se rend coupable d'un crime envers l'État, mademoiselle ?"

"Je le sais," répondit Mlle. de Lajolais, avec la plus grande ingénuité ; "mais la première fois il était innocent, Sire."

"Mais, cette fois, il ne l'est pas," répliqua Bonaparte

"Aussi c'est sa grâce que je vous demande, Sire," reprit Maria, "grâce, ou je mourrai devant vous."

L'Empereur, ne pouvant plus maitriser son émotion, se baissa vers elle en lui disant—

"Eh ! bien, oui, mademoiselle oui, je vous l'accorde. Mais, relevez-vous."

Et, lui jetant un sourire d'encouragement et de bonté, il dégagea ses mains tenues toujours avec force et s'éloigna vivement.

Le saisissement de la joie fut plus dangereux pour Mlle de Lajolais que la douleur La pauvre enfant tomba lourdement et sans connaissance sur le marbre de la galerie.

Grâce aux soins de l'Impératrice, de la Princesse Hortense et de leurs dames, Mlle de Lajolais reprit bientôt connaissance "Mon père, mon père !" murmura-t-elle aussitôt qu'elle put parler. "Oh ! que je sois la première à lui annoncer sa grâce"

Et se levant, elle voulut s'échapper des bras qui la retenaient ; mais trop faible pour tant d'émotions diverses, elle y retomba sans force.

"Rien ne presse maintenant, mademoiselle," dit une des dames ; "prenez un peu de repos et de nourriture ; vous irez une heure plus tard."

"Une heure plus tard !" se récria Maria ; "vous voulez que je retarde d'une heure l'annonce de la vie à un homme condamné à mort, surtout quand cet homme est mon père. Oh ! Madame," ajouta-t-elle, se tournant vers l'Impératrice, "laissez-moi partir de grâce ; songez que c'est mon père : qu'il a sa grâce, et qu'il ne le sait pas encore."

"Soit, mon enfant," lui répondit l'excellente Joséphine ; "mais vous ne pouvez aller seule à sa prison."

"Je suis bien venue seule à votre château," répondit-elle vivement.

"Que votre majesté nous permette d'accompagner Mlle. de Lajolais," demandèrent à la fois plusieurs officiers et aides-de-camp de l'Empereur, que l'action pourtant bien naturelle de Mlle. de Lajolais avait remplis d'admiration.

"M. de Lavalette* me rendra ce service," dit l'Impératrice, souriant gracieusement à l'un d'eux ; "ainsi que monsieur (désignant un aide-de-camp de service). Vous vous servirez d'une de mes voitures ; allez, messieurs, je vous confie Mlle. de Lajolais."

Bien qu'épuisée de fatigue, de besoin et d'émotion, Maria refusa de prendre et nourriture et repos. Elle voulut elle-même voir atteler les chevaux, presser les gens, et ne se tint en place que lorsqu'elle et ses conducteurs furent installés sur les coussins de la voiture.

Alors la voiture partit au galop de six bons chevaux : elle franchit avec une rapidité incroyable la distance qui séparait Saint-Cloud de la prison. Pendant tout le trajet, Maria, droite et raide, tenait les yeux fixés sur le chemin qu'elle avait encore à parcourir ; son regard semblait vouloir dévorer la distance ; sa poitrine haletait, comme si c'était elle, au lieu des chevaux, qui traînât le carrosse, et elle était pâle, si pâle, que deux ou trois fois ses compagnons lui adressèrent la parole, mais inutilement, elle ne les entendait pas. Quand la voiture s'arrêta, elle s'élança par-dessus le marchepied avant que M. de Lavalette eût eu le temps de lui offrir la main pour descendre, et ne pouvant articuler que ce mot, "Vite, vite !" Elle parcourait les longs corridors de la prison, précédant le geôlier et ses guides, et répétant toujours, "Vite, vite !" Arrivée à la porte du cachot, il fallut bien qu'elle attendît que le geôlier en eût ouvert la serrure, et tiré deux énormes verrous ; mais à peine la porte eut-elle cédé, que, se précipitant dans l'intérieur, elle alla tomber dans les bras de son père, en criant, "Papa, l'Empereur . . . la vie . . . grâce." . . . Elle ne put achever : sa voix se perdait en longs cris, chaque parole commencée finissait par un sanglot.

Le général de Lajolais crut un instant qu'on venait le chercher pour le conduire à la mort, et que sa fille ayant trompé la vigilance des gardiens, avait tout bravé pour lui faire ses adieux.

Mais M. de Lavalette le détrompa bientôt ; voyant que Maria vaincue par l'émotion ne pouvait articuler un son, il prit la parole :

"L'Empereur vous accorde votre grâce, général," lui dit-il," et vous la devez au courage et à la tendresse de votre fille."

Puis avec une émotion dont il ne pouvait se défendre, il raconta au général de Lajolais tout ce que sa fille avait fait pour lui.

E. MARCO DE SAINT-HILAIRE.

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* Le général Lavalette avait épousé une nièce de l'Impératrice. Condamne à mort en 1815, il fut sauvé par le généreux dévouement de sa femme, qui s'introduisit dans sa prison, et changea de vêtements avec lui.

KEY TO TRANSLATION FROM FRENCH (p. 213).

THE CARD-CASTLE.

A good husband, his wife, and two pretty children passed their days in peace in the simple hermitage where, as peaceably as they, their parents had lived. The husband and wife, sharing' the mild cares of the household, cultivated their garden, gathered in their harvests, and in the evening, in summer, supping under the leaves ; in winter, in front of their fire, they preached to their sons on virtue and wisdom, and spoke to them of the happiness which these always give. The father enlivened his sermon by a story, the mother by a caress.

The elder of these children, by nature serious and studious,

used to read and think; the younger, quick, thoughtless, but full of gracefulness, used to jump about and laugh always, and only delighted in games. One evening as usual, seated beside their father close to a table on which their mother was leaning, the elder was reading Rollin: the younger little desirous of learning of the noble deeds of the Romans or of the Parthians, was using all his art, all his faculties in joining, in supporting by the four sides a fragile card-castle. He hardly dared breathe from care and from fear. All at once the reader interrupts: "Papa," said he, "please tell me why certain warriors are called conquerors, and others founders of an empire; are these two names different?" The father was thinking for a good answer, when his younger son, overjoyed at having been able to succeed in putting up his second storey after so much work, cries out, "It is finished." His brother grumbling, is angry, and with a single stroke destroyed his tedious work; and the younger burst into tears. "My son," answers the father, "the founder is your brother, and you are the conqueror"

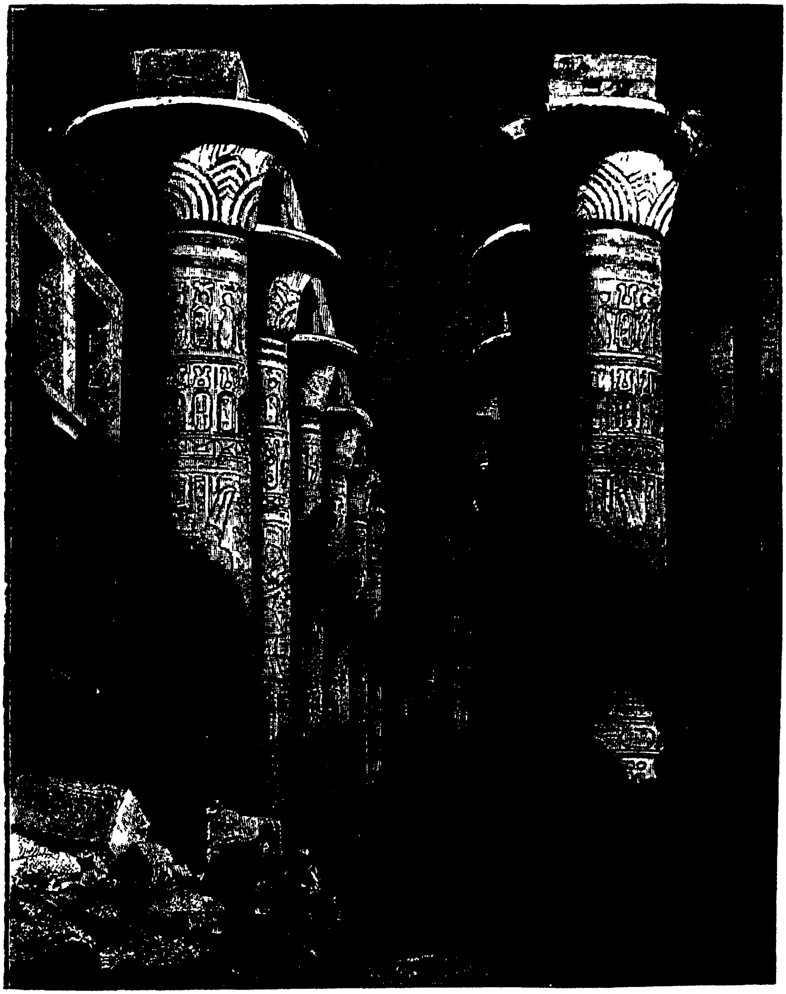

Fig. 4.—Hall of Columns, Karnak.

ARCHITECTURE.—II.

[*Continued from p.* 200.]

THE EGYPTIAN, ASSYRIAN, AND PERSIAN STYLES.

Although it is possible that the earliest settlements of mankind, subsequent to the Deluge, may have been in the alluvial plains at the mouth of the Tigris and Euphrates rivers, north of the Persian

Gulf, it is in the valley of the Nile, in North Egypt, that the most ancient architectural remains are found; and therefore, chronologically, the Egyptian Style claims our first attention.

THE EGYPTIAN STYLE.

The proximity of the ranges of hills (the Arabian and Libyan chains) to the Nile, and the facility which that river afforded for the transport of the stone quarried in them, enabled the Egyptians at an early period in the world's history to reproduce in the more lasting material, stone, those erections in crude or unburnt brick, and in timber, which, probably, for centuries formed their rude habitations, and served as sanctuaries or temples raised to the Creator of the Universe. In the tombs surrounding the Great Pyramids, which date from 3000 to 4000 years B.C., we find the earliest examples of Egyptian architecture, and the forms which they assume may be looked upon as the prototypes of that massive construction which forms its chief characteristic. The walls of their temples, and of the huge gateways, or pylons, which precede the entrances, are thicker at the bottom than at the top; consequently, the sides rake (just in the same way as the huts of unburnt brick do at the present day), and give an effect of immense solidity and strength. Of the domestic architecture of the Egyptians we know but little; the remains of her ancient splendour are found in her tombs and in her temples, and these would seem, from the representations on the walls, to have been the models on which the palaces and houses were copied. Of the tombs, the most celebrated are the Great Pyramids at Gizeh, about seven miles to the south-west of Cairo. The three Great Pyramids, with others in the necropolis of Memphis (at the period above mentioned the capital of Egypt), were the burial-places, or tombs, of the kings, or, at least, of those of royal blood. The Great Pyramid of Cheops occupied a square each side of which measured 755 feet, and covered an area equal to that of Lincoln's Inn Fields. The sides sloped up to a point 481 feet above the ground, the greatest height of any stone building in the world until the completion of the spire of Cologne Cathedral, the apex of which rises to 520 feet above the pavement. The casing of the great Pyramid and a portion of the top have already disappeared; so that in its present state it consists of a series of steps, 203 in number, varying in height from 4 feet to 2 feet 6 inches. The second Pyramid is slightly smaller, and still retains a portion of its casing at the top. The third Pyramid was less than half the size, but the casing was of granite from Syene, 500 miles above Cairo.

In the vicinity of the Pyramids, and on the west bank of the Nile, are numberless tombs which formed a portion of the necropolis of Memphis, which was fifteen miles long. These tombs are now known under the term of *mastaba*, an Arabian word signifying a "bench." These *mastabas* are rectangular masses, varying in length from 15 to 150 feet, and from 12 to 80 feet high. Their sides are sloped, so that they resemble the crude brick huts of the natives. The greater portion of them is in solid masonry or brickwork; but on the eastern side there are small chambers, some of which were open to the passer-by, and in which originally offerings were made to the deceased. These tombs all belong to the earlier dynasties. After the removal of the capital to Thebes, the tombs were always excavated in the solid rock; and though invaluable as records of history—for the walls are covered with drawings and hieroglyphics—architecturally they have but little interest.

The principal temples of Egypt are found at Thebes; and as their plans have much resemblance one to the other, it will be sufficient to take one as an example. There is this peculiarity about them—that whether they took centuries to build (being continually added to and enlarged, as the Temple of Karnak), or were built within a few years, as the Temple of Edfou (Figs. 5, 6), they all have the same accumulation of parts. The sanctuary at the back is preceded by one or more halls, one in front of the other, succeeded by a great "hall of columns," after which great courts were added one in front of the other. Each of these features increases in size or height, till the great "hall of columns" is reached, which is the finest feature in Egyptian architecture. The great hall of Karnak (Fig. 4), has a double row of twelve columns down the centre (67 feet high from ground to soffit of the stone beams, on which the stone slabs of the roof are carried, and 36 feet in circumference), and seven rows of columns on each side, of lesser height, giving a total of 98 columns; the hall covering an area of 70,000 square feet, greater than any English cathedral. In front of this hall was a court, with porticos round it; and on the entrance side, a huge pylon, or gateway, 300 feet long and 100 feet high, with an entrance-portal in the centre. Generally speaking, in front of these pylons were immense seated figures in granite or basalt, and obelisks, similar to the example now erected on the Thames Embankment; and from the entrance, a long paved causeway, flanked with pedestals carrying sphinxes, led to the river, and was used for processions. The Temple of Karnak, and others at Thebes, date principally from the middle of the 14th century B.C. At Edfou, Philæ, and Denderah are other magnificent temples of later date. The columns which supported the roofs are of two main types—

those crowned with the bell capital (Fig. 4), and those which are derived from the lotus plant with bud capital (Fig. 3); a third variety is found in the polygonal column, which has a considerable resemblance to the Greek Doric column. These three types belong to the early and middle periods of Egyptian architecture. Under the Ptolemies, the capital assumed a variety of different forms, being decorated with ornament derived from river-plants; in the Temple of Esneh, built under the Roman rule, in the hall, of twenty-four columns, there are eleven varieties of capitals; and in the Portico at Philæ even a greater number. There are some temples which are partially cut in the rock, and partially built in front; and one celebrated example at Abousimbel, which is entirely excavated in the rock to a depth of 150 feet, with hall of columns, and other halls, chambers, and sanctuary. It is in front of this temple that the huge seated figures, 60 feet high, were carved in the rock, full-sized copies of which occupied the south transept of the Crystal Palace before the fire.

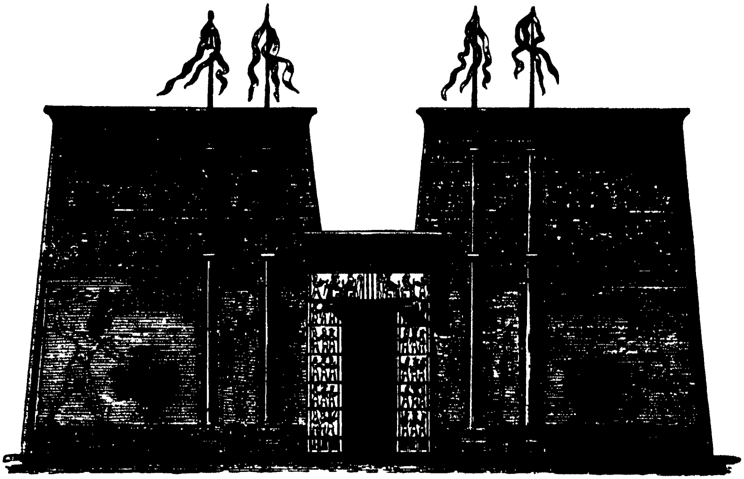

Fig. 5.—Temple of Edfou.

THE ASSYRIAN STYLE.

Though, as we have already said, there is every reason to believe that the settlements in the alluvial lands bordering on the Tigris and Euphrates, and north of the Persian Gulf, may have been earlier even than those in the valley of the Nile, the earliest records do not go back quite so far, and the most ancient remains found are not calculated to be much older than 2000 B.C.

This may be easily explained. (1) The heavy soaking rains which occasionally fall in Mesopotamia would quickly sweep away all those ephemeral constructions in unburnt brick to which we have called attention in Egypt; and (2) they had not those magnificent quarries of stone which at a very early period in her history Egypt had known how to avail herself of.

It is only within the last fifty to sixty years that excavations have been made in Mesopotamia, disclosing to us the existence of a series of palaces erected on mounds or terraces, built almost entirely in sun-dried brick, and preserved only on their outer faces by burnt brick and tiles, and, occasionally, stone.

The styles which we have now to describe are known as the Chaldean, Assyrian, and Babylonian, all of which possess similar characteristics, so that it is not necessary to distinguish them here. Of the Chaldean Style, very few remains have been found; and the duration of the Babylonian kingdom being less than a century, little more would appear to have been done beyond restoring some of the more ancient Chaldean temples; so that a description of the nature of the Assyrian Style will cover all that is requisite

Broadly speaking, there are only two classes of buildings—the temple and the palace. In order to understand the peculiar nature of these structures, it is necessary to point out that the country bordering on the Tigris and Euphrates is perfectly flat, and in periods of inundation is liable to be flooded. The first precaution, therefore, which it was necessary to take, especially in structures which were intended to be of a more permanent nature, would be to raise them on artificially constructed mounds or terraces. These, in the cases of temples and palaces, would be raised higher than others, to give them that prominence which their importance required. Beyond this, there might also be a sanitary reason, *i.e.*, to raise the palace well out of the malaria of the plains; a strategic reason, that they should command the country around; and an æsthetic reason, to give that relief and variety which the flatness of the country required. The Chaldean temple—of which a typical example is found in the Birs Nimroud, 14 miles south of Babylon, and which was restored or rebuilt by Nebuchadnezzar—consisted of a series of terraces, built one upon the other, each set back one behind the other, so as to leave a platform 12 feet all round; but set back, however, more in front, to allow of flights of stairs for ascension. The lower terrace measured 272 feet square; the height being 45 feet, or possibly more (the height of the others being of less dimensions); and the size of the top terrace but one being 75 feet square. On this rested the temple, forming the seventh terrace, and the roof of which was vaulted. These terraces were all solid, and constructed in sun-dried brick, their upper surfaces and vertical walls being protected by burnt brick, the upper storey being subjected to such heat as to be vitrified. Another typical example is found at Khorsabad, where the lower four storeys still remain; in this case, instead of flights of steps in front, a ramp was formed round the tower. The remains of colour on this temple, as well as on that of the Birs Nimroud, show that each storey was decorated with coloured materials and dedicated to the seven planets: the lowest, black, dedicated to Saturn; then orange, to Jupiter; red, to Mars; yellow, to the Sun; green, to Venus; blue, to Mercury; and white, to the Moon. The Mujelibe at Babylon is supposed to have been the largest of those temples, its base being about 600 feet, and its height calculated at 450 feet.

The Chaldean palaces are too ruined to be able to trace out their plans; they seem, however, to have been similar to those found in Assyria, the oldest of which is the North-west Palace at Nimroud, built by Asshur-bani-pal, 884 B.C. This was discovered and excavated by Sir Henry Layard, to whose exertions we owe the great bulls from the gateways and the sculptured slabs from the walls of the reception rooms which are now in the British Museum. The largest and most complete palace yet discovered is that at Khorsabad, situated about fifteen miles north of Nineveh. The city of Khorsabad was about a mile square, and in the north-west of it was built the enormous platform or terrace on which the palace stands. This platform was 30 feet high, and covered an area of about 1,000,000 square feet, or 1,000 feet each way. A flight of steps in front, and a ramp at the side up which chariots could ascend, gave access to the platform. In the front of the principal portion of the palace (330 feet wide) were three great portals flanked by human-headed bulls, those to the central entrance being 19 feet high. These led to a great court about 300 feet square, round which were the stables and offices; a second front on the right (now destroyed) led to the court of honour, beyond which were the great reception rooms of the palace, with other courts beyond surrounded by the grand apartments of the king and of the various officers of his court. On the left of the first court above mentioned were the courts and apartments of the Harem, and behind these the temple to which we have before referred. The peculiarity to be noticed in the plans of this and other palaces is 1st, the extraordinary thickness of the walls, the outer ones being 20 feet thick; and 2nd, the small width of the halls when compared with their length, the relative proportions being 150 feet long, and 30 feet wide. It was suggested by the late Mr. Fergusson that these halls were covered over with roofs carried on columns of wood; no trace of these has ever been found, however, nor of the foundations necessary to carry such features. The general tendency of the belief turns now in the direction of their having been vaulted in brick—a method of construction which would at once account for the great thickness of the walls necessary to resist the thrust of the vault, and also for the comparatively small width—the builders not knowing how to construct vaults of a greater span. The halls were probably lighted by small openings just above the springing of the vault, and from the ends above the roofs of adjoin-

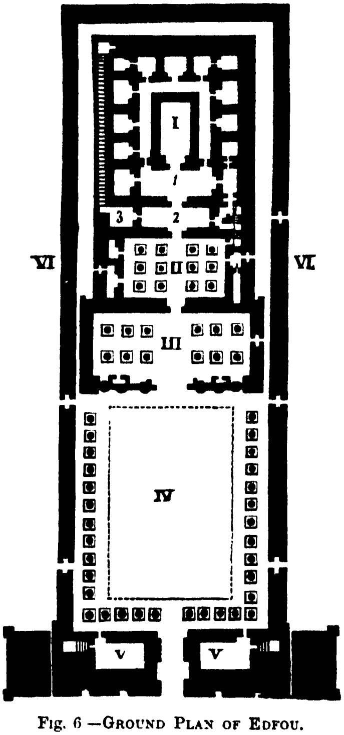

Fig. 6.—Ground Plan of Edfou.
I. Sanctuary; II. Hall of Columns; III. Great Hall of Columns; IV. Great Court; V. Pylons; VI. Outer Wall.

ing rooms. The lower portion of all the principal reception rooms was lined with slabs of alabaster carved in relief, examples of which are now in the Louvre, similar examples from Nimroud being in the British Museum. The upper portions of the rooms were all covered with stucco and decorated in colour. The entrance gateways to the courts are all covered with circular-headed arched vaults, showing that the builders were well acquainted with the principle of the arch. The open courts were paved either with stone or burnt brick tiles, and the greatest precautions were taken to drain off the water in order to prevent the disintegration of the crude brick walls and platforms. Some of the pavement slabs were cut in low relief in imitation of carpet designs, and of these we have also examples in the British Museum.

THE PERSIAN STYLE.

There remains still a third style to be described which completes the series of the great Oriental styles of architecture—viz., the Persian. It has been assumed that this style was the natural descendant of the Assyrian, simply carrying on the tradition of those styles just described. There are certain features in which their influence can be felt, but the disposition of the plans of their palaces and the features of which they are composed are in the main essentially different. In Persia we return again to a supply of that material in which the Assyrians were deficient, viz., stone; and the Persians seem also to have been able to procure timber of sufficient size and strength to use it for the coverings of their roofs. The features which they would appear to have taken from the Babylonians, whose kingdom they had laid waste, were the terraces or platforms; and much light is thrown upon the possible construction of the flight of steps in the Assyrian palaces by comparison with the examples found at Persepolis, and which, being either cut in the rock, or built in stone, still remain more or less well preserved. From the great similarity in the sculpture also we gather that the Persian conquerors brought over to their own country the artists, or the descendants of those artists, who had sculptured the slabs at Khorsabad and other Assyrian palaces, and in these two respects the Persian follows close on the Assyrian tradition. Beyond that we find ourselves in presence of an entirely different style, and one which would seem rather to be based on the palaces of Media at Ecbatana and elsewhere, described by Herodotus: with this difference, that the latter, being in wood, have entirely perished; whilst the Persians, employing, at all events for their vertical supports, the stone column, have transmitted to us the features of a wooden style which may have been in existence centuries before.

The principal remains of palaces are found at Persepolis where, upon a platform, partially built in masonry, and partially worked out in the rock, are portions of four or five palaces besides propylæa, or entrance gateways. (The approach to this platform is by a double flight of stairs, 20 feet wide, of easy acclivity and most stately appearance.) The best preserved of these is the palace of Darius, which consists of a great central hall, the roof of which was carried by sixteen columns, preceded by a porch or portico with two rows of columns, four in each row, and with smaller rooms at the side and back. The palace is raised on a platform 10 feet in height, with a double flight of stairs in front. The walls of the palace were apparently built only in unburnt brick, the outer surfaces of which were protected by burnt brick of various colours and sometimes, as at Susa, decorated with lions and figures in relief, all in coloured enamels. Those at Persepolis have all disappeared, but fortunately the angle piers and the doorways and windows were in stone, and some of these still remain, which enable us to reconstruct the palace in our imagination The principal palace on the platform is that known as the great hall of Xerxes—the Chehil Minar—which must have been one of the most splendid buildings ever erected. Its plan is similar to that of the palace of Darius, except that the great hall of columns had six rows instead of four, there being, therefore, thirty-six columns to carry the roof, and there were three porticoes, one on the front and one on each of the sides, each with two rows of six columns each. These columns were 67 feet in height, and they were crowned with capitals consisting of bulls' heads, supported (in the portico columns) by complex capitals with volutes, which are thought to be the prototypes of the Greek Ionic volutes, though differently placed. The palace covered an area of 105,000 square feet, larger than any European cathedral. A third palace had a hall whose roof was carried by 100 columns, but of much less dimensions.

The roofs of all these palaces are gone, but in the tomb of Darius, cut in the rock at the back of this platform, are imitations of the front of the palace in which he resided, and from which we think it is possible to realise their complete form. There was only one storey to the porticos and halls, the latter being probably lighted through the windows under the porticos, or by openings in the walls close under the roof and above the roofs of the adjoining chambers.

The palace of Artaxerxes at Susa seems to have been of the same character as those at Persepolis, the surface blocks of the walls, richly enamelled in colours, being in beton or concrete instead of burnt brick.

The only other remains of Persian work known are the tomb of Cyrus at Pasargadæ, a stone sarcophagus raised on a series of steps—the remains of a building close by which is thought to be a palace of Cyrus, with a hall of columns—a portico of somewhat similar nature to those described, but without ornament or enrichment of any kind—and one or two square buildings known as fire temples, but which are probably tombs.

APPLIED MECHANICS.—VI.

[*Continued from p.* 217.]

THE TURNING TENDENCY OF A FORCE—MOMENTS OF FORCES—LAW OF MOMENTS—THE LEVER AND ITS PRACTICAL APPLICATIONS—SAFETY-VALVES, WEIGHING MACHINES AND OTHER EXAMPLES.

CONSIDER now the equilibrium of a body which is free to move about an axis, and which is acted on by forces tending to turn it about that axis. The body shown in Fig. 33 will do to illustrate what we mean. We must either suppose that the body has no weight, or that it is pivoted at such a point that its weight has no tendency to turn it, which is the case in this instance if the pivot passes through its "centre of gravity." We may remark in passing that this "centre of gravity" is defined as the point through which the resultant of all the forces of gravity, acting on the body, always passes. The term "centre of mass" is much better, as it is only a certain class of bodies which *have* a centre of gravity. Imagine the arrangement shown in Fig. 33 to be frictionless, and the weights nicely adjusted so that there is no more tendency for the body to turn in one direction than the other, then if it gets one complete turn in the positive direction—or against the hands of a watch—the weight attached to C will fall a distance equal to the circumference of its pulley, whilst A and B rise distances equal, respectively, to the circumferences of their pulleys. The law of work tells us that the work done by C in falling must be equal to that done *on* A and B in raising them since we assume that there is no friction. Hence we have the rule—

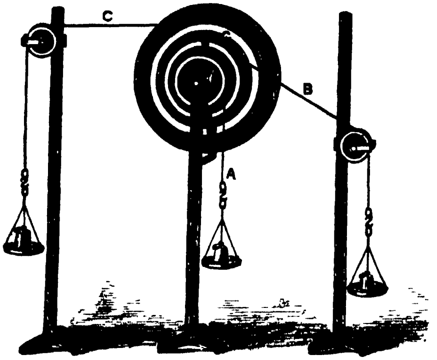

Fig. 33.

Pull in C × circumference of C's pulley
= pull in A × circumference of A's pulley + pull in B × circumference of B's pulley.

Since each circumference is 2π times its radius, dividing this equation across by 2π, we get

Pull in C × C's radius = pull in A × A's radius + pull in B × B's radius.

Now each radius is at right angles to the cord, *i.e.*, the force exerted by the cord at the point where it leaves the pulley, hence we see that each product is simply the *particular force multiplied by the perpendicular from the axis on the line showing the direction of that force.* This product gets a name, it is called the *moment* of the force about the axis referred to, and its amount is a measure of the tendency of the force to turn the body about the axis.

THE LAW OF MOMENTS

then is this, *if a number of forces act on a body tending to turn it about an axis, there will be equilibrium if the sum of the moments of the forces tending to turn it against the hands of a watch is equal to the sum of the moments of the forces tending to turn it with the hands of a watch*: or in other words, if the algebraic sum of the moments is zero. We think we can hear the intelligent student objecting here, and saying, "You have in your illustration only taken a particular case in which the distance of each force from the axis remains constant," and that in practical examples this is not usually the case. The objection is perfectly right, and we will endeavour to meet it. In doing so we must adopt a method which we have already used, viz., that of supposing a very small motion given to the body, the cords being attached directly without pulleys. Let the small angle turned through by the body be called α (Fig. 34), all lines on the body will turn through the same angle. Fig. 35 is an enlarged drawing of a part of Fig. 34, and it will be seen from it that the work done by W_1 is $W_1 \times PQ$. But since OM is perpendicular to PM, and OP perpendicular to PT, the two triangles OMP and TQP have the angles at O and P equal, and the angles at Q and M also equal, being right angles, hence the triangles are similar, therefore $\frac{QP}{PT} = \frac{OM}{OP}$.

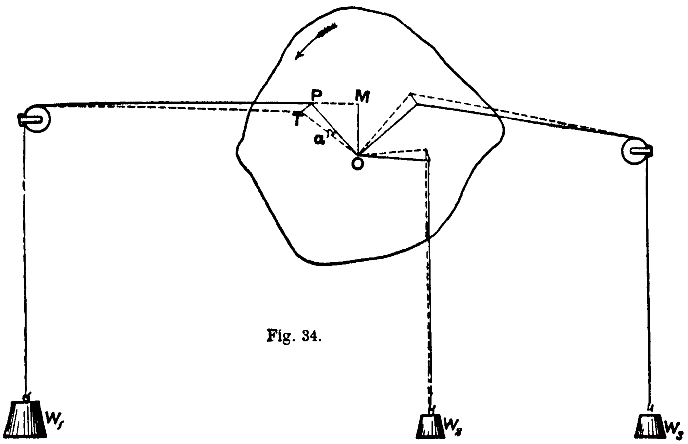

Fig. 34.

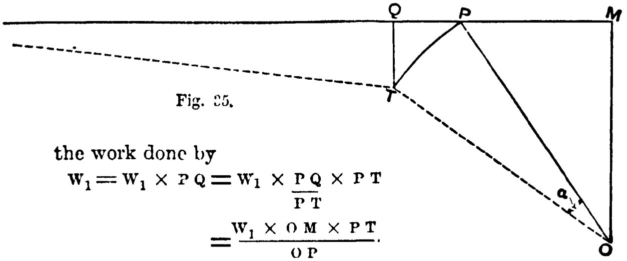

Fig. 35.

the work done by

$$W_1 = W_1 \times PQ = W_1 \times \frac{PQ}{PT} \times PT$$

$$= \frac{W_1 \times OM \times PT}{OP}.$$

But the angle $\alpha = \frac{PT}{OP}$ (in radians).

∴ the work done by $W_1 = W_1 \times OM \times \alpha$.

Similarly the work done on W_2 can be shown to be equal to $W_2 \times$ its perpendicular $\times \alpha$, and so on for W_3, etc.; whence dividing across by α, we get from the law of work the same rule as before—

$W_1 \times$ its perpendicular $= W_2 \times$ its perpendicular
$+ W_3 \times$ its perpendicular

Or the algebraic sum of the moments of all the forces must be zero.

The student should carefully study this proof, as it has not, so far as we are aware, appeared in print before, and the method adopted will often be found of great service.

THE LEVER.

We are now in a position to consider the lever and some of its practical applications. No matter how many forces act on a lever, they will balance when the *sum of their moments about the axis or fulcrum is zero.* If the axis is not in the (so-called) centre of gravity of the lever, then the lever's weight will form one of the forces and will act vertically downwards through the "centre of gravity." If only two forces act on the lever, say on different sides of the fulcrum—which is, let us suppose, at the mass-centre referred to above—then since one force multiplied by its perpendicular or "arm" equals the product of the other force and its arm, the forces must be *inversely as the arms or distances at which they act.* This is sometimes called the law of the lever, though the lever is usually loaded in a much more complicated way, and there is *no* general law except the law of moments. In certain books on mechanics levers with two forces *only* acting on each are considered, and three different *orders* of levers are the result of certain changes in the position of these forces. There is no reason why we should consider a lever with only *two* forces, as such rarely occurs in practice; if we let each interchange of position produce a different *order of lever,* we might as well have a hundred different orders as three.

PRACTICAL APPLICATIONS OF THE LEVER.

As a practical example, consider the lever safety-valve shown in Fig. 36. Suppose the valve A is just to open when the steam pressure under it is 120 lb. per square inch, that the mean area of the valve exposed to steam pressure is 4 square inches, the weight of the valve 4 lb., the distance C D being 3 inches, the centre of gravity of the lever 7 inches from D, and its weight 6 lb.; where must the weight E—which is 50 lb.—be placed on the lever? The total upward force on the valve is

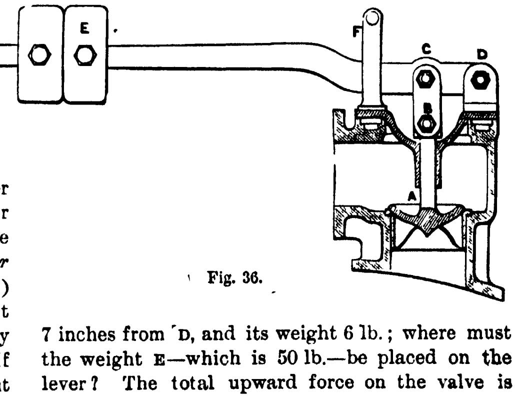

Fig. 36.

$120 \times 4 - 4 = 476$ lb., and the moment of this force about D is $476 \times 3 = 1428$.

This is the only *negative* moment, all the other forces tending to turn the lever the opposite way.

The moment of the weight of the lever is $7 \times 6 = 42$.

Let x inches be the required distance of the centre of E from the axis D, then $50x$ is the moment of the weight E about D. Our law of moments tells us that if there is to be equilibrium,

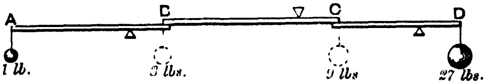

Fig. 37.

$$50x + 42 = 1428$$
$$\text{or } 50x = 1428 - 42 = 1386$$
$$\therefore x = \frac{1386}{50} = 27{\cdot}72 \text{ inches, which is the distance required.}$$

It will readily be understood that the same method as that adopted for finding the conditions of equilibrium for a single lever may be applied to any combination of levers. Thus if the ratio of the two arms of a lever A B (Fig. 37) be such that 1 lb. at A supports 3 lb. at B as shown, it is just the same whether the long arm of another lever apply that force or a direct weight. So the 3 lb. upward force at B will balance a force of 9 lb. at C, which again will balance 27 lb. at D, the levers being all similar as regards the ratio of their arms.

It is easy to see, however, that if much motion takes place there will no longer be equilibrium, as the distance from either fulcrum of the point of contact, say, of the two levers at B, will not be the same, if, indeed, the levers do not slip past each other.

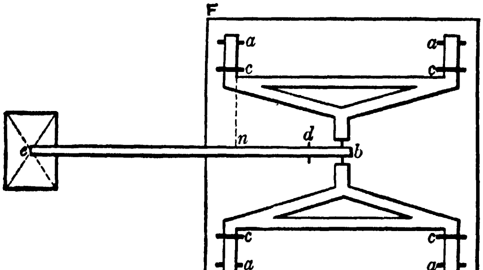

Fig 38.

A very interesting combination of levers is shown in plan in Fig. 38. It is a well-known cart weighing-machine used in many farmyards. It consists of a square frame F F, at the four corners of which are four supports or fulcra *a*, *a*, *a*, *a*, on which the extremities of the triangular levers *a*, *c*, *b* ; *a*, *c*, *b*, rest. Each lever has, therefore, two supports, in fact, we may consider each as two levers bent so as to meet at *b*. At the points *c*, *c*, *c*, *c*, each 5 inches from *a*, the top plate or platform, which receives the cart, rests by four feet. The bent levers are suspended, by steel links at *b*, to the straight lever *b d e*, the fulcrum of which is at *d*. The ratio of *b d* to *d e* is as 1 to 7, and the perpendicular distance *a n* is to *c a* as 1 to 4 ; hence the combined effect is that 1 lb. at *e* will balance $4 \times 7 = 28$ lb. of load on the platform. We have not taken into account the weights of the levers or platform, but by properly placing each fulcrum these weights can be allowed for so that each weight placed on the weighing lever will represent exactly 28 times its real weight.

In the case of a more complicated weighing machine, such as that shown in outline in Fig. 39, it will be necessary to take into account the weights of the different parts. Let x lb. be the pull in the rod A B *at its lower end*, then a little consideration will convince the student that the pull in the rod at its upper end is $x +$ the weight of the rod, in this case $x + 20$ lb. It may seem a little strange to the beginner that the rod should act on the lever O A *upwards* with a certain force, and that it should also act on the lever B C *downwards* and with a greater force. Imagining the rod to be of india-rubber in a stretched condition will assist in reasoning as to the different *sense* of the two pulls, and thinking of the rod as being merely suspended from the lever B C, when the pull at the top is 20 lb. and at the bottom 0 lb., and then adding x lb. to each, will show the reason of the different *amounts* of the forces.

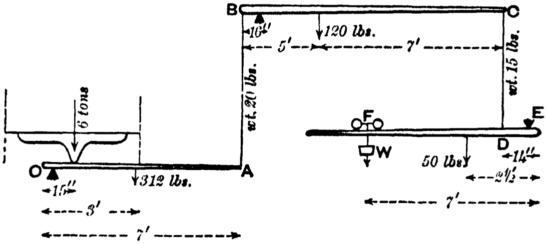

Fig. 39.

With this explanation let us now solve the question, which is to find the magnitude of the movable weight W, when the load on the machine, including platform, is 6 tons, and the distance of W from the fulcrum is 7 feet, all dimensions being as stated in the figure.

As already stated, let x lb. be the pull of the rod

A B on the lever **O A**. Then taking moments about the fulcrum at O, we have

$$6 \times 2240 \times 1{\cdot}25 + 312 \times 8 = x \times 7,$$
$$\text{or } 16800 + 936 = 7x;$$
$$\text{whence } x = \frac{17736}{7} = 2538{\cdot}7 \text{ lb.}$$

The pull of the rod **A B** on the lever **B C** is $x + 20 = 2553{\cdot}7$ lb.

Considering the equilibrium of the lever **B C**, putting y for the pull in the rod **C D** at its upper end, and taking moments, as before, about the fulcrum

$$2553\ 7 \times \frac{16}{12} = 120 \times \left(5 - \frac{16}{12}\right) + y \times \left(12 - \frac{16}{12}\right),$$
$$\text{or } 2553{\cdot}7 \times 4 = 120 \times 11 + y \times 32;$$
$$\therefore\ 10214{\cdot}8 = 1320 + 82y,$$
$$\text{whence } y = 277{\cdot}96 \text{ lb.}$$

For a similar reason to that already discussed the pull of the rod **C D** on the lever **F E** is $y - 15$ lb. $= 262{\cdot}96$ lb., and the equilibrium of the last lever gives us the equation

$$262{\cdot}96 \times \frac{14}{12} = 50 \times 2{\cdot}5 + w \times 7,$$
$$\text{or } 306{\cdot}79 = 125 + 7w;$$
$$\therefore\ w = 25{\cdot}97 \text{ lb. or } 26 \text{ lb. nearly.}$$

CENTRE OF GRAVITY.

The position of the centre of gravity or mass-centre of a body of uniform thickness, such as a plate, can be found by an application of the law of moments.

It is easy to show, by the aid of a little geometry, that the centre of gravity of a pyramid or cone, for instance, is in the line joining the centre of the base to the apex, and at a point a quarter of its length from the base. In fact, *when a homogeneous body contains a point such that all lines drawn in the body are bisected by it, this point is the mass-centre or centre of gravity of the body.* The application of the law of moments in finding the "centre of gravity," or more properly the *centre of area*, of the outline of a body of uniform thickness will be understood from an example.

Example.—A uniform circular disc 6 inches in diameter has a circular hole 2 inches in diameter punched out of it, as shown in Fig. 40, the edge of the hole passing through the centre of the disc; find the centre of gravity of the remainder of the disc.

Let x inches be the distance of the new centre of gravity from the centre of the plate, then if we imagine the hole to be again filled by the piece cut out of it, there will be equilibrium about the centre of the completed disc. Taking moments about that centre and remembering that the weight of each part is simply proportional to its area, and for our purpose may be taken *as* that area, and that the area of a circle is ·7854 times the square of its diameter, we have

$$\cdot7854 \times 2^2 \times 1 = \cdot7854\,(6^2 - 2^2) \times x,$$
$$\text{or } 2^2 = (6^2 - 2^2)\,x,$$
$$4 = (36 - 4)\,x;$$
$$\therefore\ x = \frac{4}{82} = \tfrac{1}{8},$$

i.e., the centre of gravity has moved over $\frac{1}{8}$ of an inch.

Examples might be multiplied, but the practical man will probably find the centre of gravity in a case of this kind by suspending the plate successively from two different points near the edge of the plate, and marking the direction of a plumb-line from the point of suspension in each case, these two lines crossing at the point required. In the case of an irregular body, if the mass-centre is to be found by calculation, the following principle must be adopted.

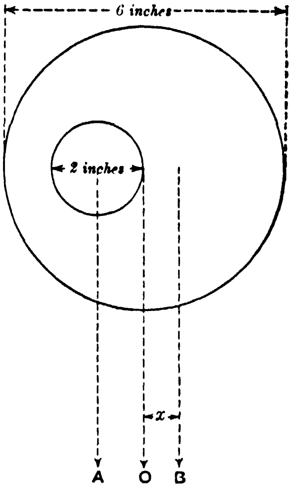

Fig. 40.

Let the body be divided into a large number of small masses m_1 m_2 m_3, etc.; find the distance of the centre of each from any fixed plane, multiply each mass by its distance, and add all these products together. Divide this sum by the sum of all the little masses, *i.e.*, the whole mass, and the quotient is the distance of the mass-centre from the plane. If this is done for three reference planes at right angles to each other, the distance of the required point from these planes is found, and therefore its position in the body determined. Graphic methods on this principle may also be adopted.

TWO EQUILIBRANTS OF A NUMBER OF PARALLEL FORCES.

In all the applications of the law of moments we have taken up, one force or one distance only was unknown and required. In some cases two forces are to be found which will balance a number of given forces, the directions of the required forces being, however, known. For instance, one is often given the loads on a beam which is supported at the ends, and the supporting forces are to be found. An example will make this point clear.

Example.—Find the two supporting forces of the beam shown in Fig. 41. Let the supporting forces be x and y lb. respectively. Then it is evident that $x + y$ must be equal to the sum of the loads as the beam does not move up or down. This gives us the first condition $x + y = 42$.

Taking moments about the point A, we have

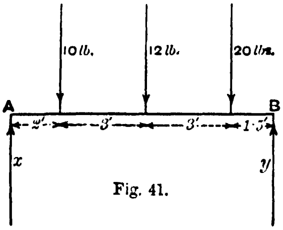

Fig. 41.

$$10 \times 2 + 12 \times 5 + 20 \times 8 = y \times 9{\cdot}5,$$

i.e., $20 + 60 + 160 = 9{\cdot}5y$,

$$\frac{240}{9{\cdot}5} = y \therefore y = 25{\cdot}26 \text{ lb.}$$

And since $x + y = 42$, x must be 16·74 lb.

This is a very common class of question in connection with problems on beams, etc.

Before leaving this subject we must refer to the units in which moments are usually measured. If the force is in pounds, and the perpendicular in feet, the product or moment will be expressed in pounds and feet, and the unit will be a quantity resembling the unit of work. In the case of work the product was that of a force and distance *measured in its own direction*, here the product is that of a force and a distance *measured at right angles to its direction* No convention has yet been adopted to distinguish between the two cases, though it has been suggested that the symbol $\sqrt{-1}$ should be prefixed to the product in the latter case. It is usual to speak of the unit of work as a foot-pound and of the unit of moment as a pound-foot, this being merely to make a sort of distinction between the two. A moment is a *rector* quantity of a class sometimes called "localised vectors" or "rotors"; a quantity of energy, on the other hand, is a *scalar* quantity or mere numeric. Moments can be compounded like forces, the line representing the moment being given in position and supposed to be the axis of the moment, and a proper convention being adopted as to the connection between the arrow head on the line and the direction of rotation of the moment. Two equal, opposite, and parallel forces, acting on a body, tend to produce rotation *only*, and form what is called a *couple*. The moment of a couple is the product of one of the equal forces and the perpendicular distance between the two.

ALGEBRA.—XVII.

[*Continued from p.* 221.]

HARMONICAL PROGRESSION.

283. Three quantities are in harmonical progression *when the first is to the third as the difference of the first and second is to the difference of the second and third.*

It is essential that these differences should be formed in the same order—that is to say, by subtracting either the second from the first, and the third from the second; or the first from the second, and the second from the third. Thus it will not do to subtract the second quantity from the first, and the second from the third. For the sake of exactness in this respect, and also for the sake of brevity, a well known mathematician (Todhunter) prefers to use symbols, and gives the following definition of harmonical progression:—

Three quantities a, b, c are said to be in harmonical progression when $a : c :: a - b : b - c$.

A series of quantities, more than three in number, may be in harmonical progression, *provided every three consecutive quantities are in harmonical progression.*

284. In consequence of the fact that the reciprocals of quantities in harmonical progression are in arithmetical progression, a third definition has been thus stated: *Quantities are said to be in harmonical progression when their reciprocals are in arithmetical progression.*

The fact that the reciprocals are in arithmetical progression may be seen by the following

EXAMPLE.—Let x, y, z be in harmonical progression represented thus.—

$$x : z :: x - y : y - z.$$

$$\text{Therefore, } z(x - y) = x(y - z).$$

And dividing by xyz, we get—

$$\frac{1}{y} - \frac{1}{x} = \frac{1}{z} - \frac{1}{y},$$

where it is clear that x, y, and z must be in arithmetical progression.

285. This property of the reciprocals gives us a method by means of which *to insert a given number of harmonical means between two given terms.*

If a and x be two given terms, and n the number of terms to be inserted, then it is evident that the problem may be solved by inserting n arithmetical means between $\frac{1}{a}$ and $\frac{1}{x}$.

This would make the arithmetical series—

$$\frac{1}{a}, \quad \frac{x(n+1) + a - x}{ax(n+1)}, \quad \frac{x(n+1) + 2(a - x)}{ax(n+1)},$$
$$\ldots\ldots \frac{x(n+1) + n(a - x)}{ax(n+1)}, \quad \frac{1}{x}.$$

And the harmonical progression would necessarily be—

$$a, \quad \frac{ax(n+1)}{x(n+1) + a - x}, \quad \frac{ax(n+1)}{x(n+1) + 2(a - x)},$$
$$\ldots\ldots \frac{ax(n+1)}{x(n+1) + n(a - x)}, \quad x.$$

286. No formula can be established for the sum of any number of quantities.

EXERCISE 73.

1. Insert harmonical means between $\frac{1}{10}$ and $\frac{1}{30}$.
2. Continue the series 2, $\frac{4}{5}$, $\frac{1}{2}$ for 8 terms.
3. If x, y, z are in harmonical progression, show that $\frac{x}{y+z}$, $\frac{y}{z+x}$, and $\frac{z}{x+y}$ are so likewise.

EVOLUTION OF COMPOUND QUANTITIES.

287. **Rule.**—1. *Arrange the terms according to the powers of one of the letters, so that the highest power shall stand first, the next highest next, etc.*

2. *Take the root of the first term, for the first term of the required root.*

3. *Subtract the power from the given quantity, and divide the first term of the remainder by the first term of the root involved to the next inferior power and multiplied by the index of the given power; the quotient will be the next term of the root.*

4. *Subtract the power of the terms already found from the given quantity, and, using the same divisor, proceed as before.*

Proof.—*This rule verifies itself.* For the root, whenever a new term is added to it, is involved, for the purpose of subtracting its power from the given quantity; and when the power is *equal* to this quantity, it is evident the true root is found.

Example.—Extract the cube root of

$$\begin{array}{ll} & a^6+3a^5-3a^4-11a^3+6a^2+12a-8\,(a^2+a- \\ & a^6 \\ \hline \text{Divisor A)} & 3a^5-3a^4-11a^3 \\ 3a^4+3a^3+a^2 & 3a^5+3a^4+\quad a^3 \\ \hline \text{Divisor B)} & -6a^4-12a^3+6a^2+12a-8 \\ 3a^4+6a^3-3a^2-6a+4 & -6a^4-12a^3+6a^2+12a-8 \\ \hline & \quad *\qquad *\qquad * \end{array}$$

Divisor A is thus found,

$$\begin{array}{r} 3(a^2)^2 \\ 3\times a\times a^2 \\ (a)^2 \\ \hline \text{Sum} = 3a^4+3a^3+a^2 \end{array}$$

Divisor B is thus found,

$$\begin{array}{r} 3(a^2+a)^2 \\ 3\times(-2)\times(a^2+a) \\ (-2)^2 \\ \hline \text{Sum} = 3a^4+6a^3-3a^2-6a+4 \end{array}$$

N.B.—In finding the divisor in the 4th example of Exercise 74, the term $2a$ in the root is not involved, because the power next below the square is the first power.

288. The *square* root may be extracted by the following

Rule.—1. *Arrange the terms of the given quantity according to the powers of one of the letters, take the root of the first term for the first term of the required root, and subtract the power from the given quantity.*

2. *Bring down two other terms for a dividend. Divide by double the root already found, and add the quotient both to the root and to the divisor. Multiply the divisor, thus increased, into the term last placed in the root, and subtract the product from the dividend.*

3. *Bring down two or three additional terms, and proceed as before.*

Proof.—*Multiply the root into itself, and if the product is equal to the given quantity, the work is right.*

Example.—What is the square root of

$$\begin{array}{lll} & & a^2+2ab+b^2+2ac+2bc+c^2\,(a+b+c \\ & & a^2, \text{ the first subtrahend.} \\ \hline 2a+b) & * & 2ab+b^2 \\ \text{Into } b = & & 2ab+b^2, \text{ the second subtrahend.} \\ \hline 2a+2b+c) & *\ * & 2ac+2bc+c^2 \\ \text{Into } c = & & 2ac+2bc+c^2, \text{ the third subtrahend.} \\ \hline \end{array}$$

Proof.—The square of the root $a+b+c$ is equal to the given quantity.

For $(a+b)^2 = a^2+2ab+b^2 = a^2+(2a+b)\times b$.

And substituting $h = a+b$, the square $h^2 = a^2+(2a+b)\times b$.

And $(a+b+c)^2 = (h+c)^2 = h^2+(2h+c)\times c$; that is, restoring the values of h and h^2,

$(a+b+c)^2 = a^2+(2a+b)\times b+(2a+2b+c)\times c$.

In the same manner it may be proved that, if another term be added to the root, the power will be increased by the product of that term into itself, and into twice the sum of the preceding terms.

The demonstration will be substantially the same, if some of the terms be *negative*.

It will frequently facilitate the extraction of roots to consider the index as composed of two or more *factors*.

Thus $a^{\frac{1}{4}} = a^{\frac{1}{2}\times\frac{1}{2}}$. And $a^{\frac{1}{6}} = a^{\frac{1}{3}\times\frac{1}{2}}$. That is—

The *fourth* root is equal to the *square* root of the *square* root;

The *sixth* root is equal to the *square* root of the *cube* root;

The *eighth* root is equal to the *square* root of the *fourth* root, etc.

To find the *sixth* root, therefore, we may first extract the *cube* root, and then the *square* root of that result.

EXERCISE 74.

1. Find the 4th root of $a^4+8a^3+24a^2+32a+16$.
2. Find the 5th root of $a^5+5a^4b+10a^3b^2+10a^2b^3+5ab+b^5$.
3. Find the cube root of $a^3-6a^2b+12ab^2-8b^3$
4. Find the square root of $4a^2-12ab+9b^2+16ah-24bh+16h^2$.
5. Find the square root of $1-4b+4b^2+2y-4by+y^2$.
6. Find the square root of $a^6-2a^5+3a^4-2a^3+a^2$.
7. Find the square root of $a^4+4a^2b+4b^2-4a^2-8b+4$.
8. Find the square root of $x^4-4x^3+6x^2-4x+1$.
9 Find the cube root of $x^6-6x^5+15x^4-20x^3+15x^2-6x+1$.

10. Find the square root of $4x^4 - 4x^3 + 13x^2 - 6x + 9$.
11. Find the 4th root of $16a^4 - 96a^3x + 216a^2x^2 - 216ax^3 + 81x^4$.
12. Find the 5th root of $x^5 + 5x^4 + 10x^3 + 10x^2 + 5x + 1$.
13. Find the 6th root of $a^6 - 6a^5b + 15a^4b^2 - 20a^3b^3 + 15a^2b^4 - 6ab^5 + b^6$.

INDETERMINATE EQUATIONS.

289. When there are more unknown quantities than independent equations, the number of corresponding values which those quantities admit is indefinite. This number may be lessened by rejecting all the values which are not *integers*, and it may be further lessened by rejecting all the *negative values*.

An indeterminate equation of two unknown quantities of the *first degree* is of the form $mx + ny = d$; and here it may be remarked that this equation *cannot* be solved in whole numbers unless m and n are *prime* to each other, and that if one solution be given or found, all the others may be derived from it.

In the equation $mx - ny = \pm d$, the solution in whole numbers is *always* possible if m and n be prime to each other, and then an indefinite number of integral values may be assigned to x and y which satisfy the equation.

In the equation $mx + ny = d$, the solution in whole numbers is *always* possible provided d be *greater* than $mn - m - n$.

EXAMPLES.

1. In how many ways can a guinea be paid by using shillings and crown pieces only?

Let $x =$ the number of shillings, and $y =$ the number of crowns, then $x + 5y = 21$ (taking all the values in shillings); $\therefore x = 21 - 5y$, where we see that to know the value of x we may assume y at pleasure; but since x must be a *positive integer* from the nature of the problem, it is natural to assume y equal to the consecutive whole numbers 1, 2, 3, etc.

If $y = 1, 2, 3, 4$, then $x = 16, 11, 6, 1$; and if y be taken $= 5$, this gives x a negative value; therefore the problem admits only of the above four solutions, and it is easy to test the correctness of the values thus found.

1 crown and 16 shillings; 2 crowns and 11 shillings; 3 crowns and 6 shillings; 4 crowns and 1 shilling—all equal 1 guinea, as required. *Ans.*

2. The difference between the values of $\frac{1}{12}$ of 5 lb. of salt butter, and $\frac{1}{7}$ of 2 lb. of fresh ditto, is $\frac{1}{4}$ of a penny. Find the price per lb. of each in integers.

Let $x =$ the price per lb. of the salt butter,
And $y =$ „ „ „ fresh butter;
Then, by the question, $\frac{5x}{12} - \frac{2y}{7} = \frac{1}{4}$.

Now, multiplying by 84 (the least common multiple of 12, 7, and 4), we have $35x - 24y = 21$; from which $y = \frac{35x - 21}{24}$; and here it may be remarked that it is best to find the value of that unknown which has the *least* coefficient (in this case y).

Now $\frac{35x - 21}{24} = x + \frac{11x - 21}{24}$ (A). Now, since x is to be an integer, $\frac{11x - 21}{24}$ must be one also; $\therefore$ put $\frac{11x - 21}{24} = m$, whence $x = \frac{24m + 21}{11} = 2m + 1 + \frac{2m + 10}{11}$ (B). Now, for a similar reason, assume $\frac{2m + 10}{11} = n$, then $m = \frac{11n - 10}{2} = 5n - 5 + \frac{n}{2}$(C). Now assume $\frac{n}{2} = r$, then $n = 2r$. Remembering that all the indeterminates y, x, m, n have an integral value, we retrace our steps by substitution, and have from (C), substituting $2r$ for n, $m = 10r - 5 + r = 11r - 5$; from (B), by substituting $11r - 5$ for m, $x = 22r - 10 + 1 + 2r = 24r - 9$; from (A), by substituting $24r - 9$ for x, $y = 24r - 9 + 11r - 5 = 35r - 14$. The two unknowns in terms of r are, therefore, $x = 24r - 9$, and $y = 35r - 14$, from which we see that any positive integer, from 1 to infinity, for the value of r, will give positive integers for the values of x and y. Thus—

If $r = 1, 2, 3, 4$, etc., increasing by 1;
$x = 15, 39, 63, 87$, etc., increasing by 24;
$y = 21, 56, 91, 126$, etc., increasing by 35.

Observe that the different values of x and y form *arithmetical progressions*, whose common differences are 24 and 35 respectively; that formed by the values of x has the coefficient of y (*in the given equation*) for its common difference, and the one formed by the values of y has the coefficient of x for its common difference. We also see from these two examples, that when the two unknowns have the *same* sign, the number of solutions is *limited;* but that the number is *unlimited* when they have *different* signs.

3. At a country railway station the money taken was £3. The tickets issued were for fares of 2s., 3s., and 5s. each. How many of each were issued? also find how many solutions the question admits of.

Let x, y, z represent the numbers of the different kinds; then by the question, $2x + 3y + 5z = 60$; whence $x = \frac{60 - 3y - 5z}{2} = 30 - y - 2z - \frac{y + z}{2}$; put $\frac{y + z}{2} = t$; then $y = 2t - z$, and $x = 30 - y - 2z - t = 30 - 3t - z$; if $z = 1$, then $x = 29 - 3t$, and

$y = 2t - 1$; to make x and y whole numbers, t cannot be *more* than 9 nor *less* than 1 (thus giving 9 solutions).

$$\begin{aligned} \text{If } t &= 1, 2, 3, 4, 5, 6, 7, 8, 9; \\ x &= 26, 23, 20, 17, 14, 11, 8, 5, 2; \\ y &= 1, 3, 5, 7, 9, 11, 13, 15, 17; \\ z &= 1, 1, 1, 1, 1, 1, 1, 1, 1. \end{aligned}$$

If $z = 2$, then $x = 28 - 3t$, and $y = 2t - 2$; t cannot be *greater* than 9 nor *less* than 2.

$$\begin{aligned} \text{If } t &= 2, 3, 4, 5, 6, 7, 8, 9; \\ x &= 22, 19, 16, 13, 10, 7, 4; \\ y &= 2, 4, 6, 8, 10, 12, 14, 16; \\ z &= 2, 2, 2, 2, 2, 2, 2, 2; \end{aligned}$$

thus giving 8 more solutions.

If $z = 3$, $x = 27 - 3t$, and $y = 2t - 3$, from which we see t cannot be *more* than 8 nor *less* than 2; thus giving 7 more solutions.

If $z = 4$, $x = 26 - 3t$, and $y = 2t - 4$, where t cannot be *more* than 8 nor *less* than 3; thus giving 6 more solutions.

If $z = 5$, $x = 25 - 3t$, and $y = 2t - 5$ where t cannot be *more* than 8 nor *less* than 3; thus giving 6 more solutions.

If $z = 6$, $x = 24 - 3t$, and $y = 2t - 6$, where t cannot be *more* than 7 nor *less* than 4; thus giving 4 more solutions.

If $z = 7$, $x = 23 - 3t$, and $y = 2t - 7$, where t cannot be *more* than 7 nor *less* than 4; thus giving 4 more solutions.

If $z = 8$, $x = 22 - 3t$, and $y = 2t - 8$, where t cannot be *more* than 7 nor *less* than 5; thus giving 3 more solutions.

If $z = 9$, then $x = 21 - 3t$, and $y = 2t - 9$, where t cannot be *more* than 6 nor *less* than 5; thus giving 2 more solutions.

If $z = 10$, then $x = 20 - 3t$, and $y = 2t - 10$, where t can *only* be 6; thus giving 1 more solution.

If $z = 11$, then $x = 19 - 3t$, and $y = 2t - 11$, where t can *only* be 6; thus giving 1 more solution.

From the given equation, $2x + 3y + 5z = 60$, we see z cannot be *more* than 11; hence there are $9 + 8 + 7 + 6 + 6 + 4 + 4 + 3 + 2 + 1 + 1 = 51$ solutions to this question.

290. From the foregoing examples we may deduce the following

Rule.—If a simple equation express the relation of two unknown quantities, and their corresponding *integral* values be required, divide the whole equation by the coefficient which is the *less* of the two, and suppose that part of the result which is in a fractional form equal to some *whole* number; thus a new simple equation is found, with which we must proceed as before, and so on till the coefficient of one of the unknown quantities is 1, and the coefficient of the other a whole number; then an integral value of the former may be found by substituting 0, or any *whole* number for the other; and from the preceding equations *integral* values of the original unknown quantities may be found.

EXERCISE 75.

1. Find the number of solutions, and the respective values of x, y, and z, in the equation $5x + 8y + 7z = 50$.

2. Find the number of solutions, and the values of x, y, and z, in the equations

$$\begin{cases} 5x + 7y - 3z = 10. \\ 5x - 2y + 4z = 13. \end{cases}$$

3. Find the number of solutions, and the values of x, y, z, and m, in the equations

$$\begin{cases} x + y + z + m = 10. \\ 3x - 3y + 4z - m = 3. \\ 4x - 4z + m = 6y. \end{cases}$$

4. Find the number of solutions, and the values of x, y, z, and n, in the equations

$$\begin{cases} x + y + z + 2n = 100. \\ 10x + 5y + 2z + n = 100. \end{cases}$$

5. Bought 100 animals for £100; there were cows at £5, sheep at £1, and rabbits at 1s. How many solutions will this question admit of? and what was the price of each?

6. A person had a bag of nuts containing (he said) less than 500, and if he counted them by twos, threes, fours, fives, or sixes, there was always an odd one; but when he counted them by sevens, there was none left. How many nuts did he have?

7. I retired to rest one evening at m minutes to n o'clock; and on rising 6 hours 55 minutes after, it wanted n minutes to m o'clock. Find the times of retiring to rest and getting up.

8. Find a sum consisting of P shillings and S pounds, the double of which is P pounds and S shillings.

9. What is the value of x when £x and 18 shillings are twice the value of £18 and x shillings?

10. Divide 1591 into two parts, respectively divisible the one by 23 and the other by 34, and state the number of solutions.

11. Divide $\frac{58}{77}$ into two other fractions, whose denominators shall be 7 and 11.

12. Find two whole numbers whose sum and product together = 139, and how many solutions.

13. Divide 30 into 3 such parts that the 1st × 7, 2nd × 19, and 3rd × 38, the sum of products = 745. What are the parts?

14. Into what two parts must 4890 be divided that the 1st ÷ 37 may leave the remainder 3, and the 2nd ÷ 54 may leave the remainder 6?

15. I have a quantity of malt, weighing 39 lb. per bushel, and if I had 5 lb. *more* it would measure an exact number of bushels; or if I had 5 lb. *less* it would weigh an *exact* number of cwt. What is the smallest quantity I can have to satisfy these conditions?

16. If I take out the nuts from a bag in successive quantities—thus, 1 the first draw, 2 the second, 4 the third, 8 the fourth, etc.—I find that on taking out the last term of this progression no nuts will remain; I also find that if I had drawn them out in lots of 17 each, there would have been none left after a certain number of draws. Required the number of nuts.

KEY TO EXERCISES.

EXERCISE 70.

1. $3\frac{1}{3}$.
2. 24 and 32.
3. 10 and 8.
4. 8 and 6.
5. 6.
6. 4 and 6.
7. 20 and 24.
8. 30 bushels at first; sold $13\frac{1}{4}$ bushels.
9. 15 and 9.
10. 10 and 2.
11. 18 and 6.
12. 25 gallons of rum, 5 gallons of brandy.
13. 24 and 16.
14. 20 and 16.
15. 32 and 18

EXERCISE 71.

1. $n=4$, $a=4$, $z=256$; from which $r=4$, and the series $=4, 16, 64, 256$.
2. $r=3$, and the series $=\frac{1}{9}, \frac{1}{3}, 1, 3, 9$.
3. $s=\frac{121}{162}$, $z=\frac{1}{162}$.
4. 1093.
5. $z=$ [illegible], $s=2$[illegible].
6. $z=8192$, $s=16382$.
7. $z=531441$, $s=797160$
8. £965114681693 13s. 4d.

EXERCISE 72.

1. 2, 4, and 8.
2. 2, 10, and 50.
3. 5, 10, 20, and 40.
4. £120, £60, and £30.
5. 5, 10, and 20.
6. 1, 3, 9, and 27.

ITALIAN.—V.

[*Continued from p.* 227.]

VOCABULARY.

Abbigliamento, ornament, dress, fitting out, equipment.
Abilità, ability.
Acciaio, steel.
Acqua, water.
Affare, affair, business; station of life, condition, rank (*uomo di grand'affari*, a man of consequence or importance; a very able or clever man; a man of superior genius or talents).
Altrettanto, as much again.
Anno, year.
Argento, silver.
Arte, art.
Barca, barge, boat, (*ponte di barche*, pontoon).
Basso, m., *bassa*, f., low.
Bello, beautiful, fine.
Briccone, rogue, scoundrel.
Campo, camp.
Cannone, cannon.
Cappello, hat.
Carattere, character, handwriting, hand (*caratteri*, pl., types, letters).
Cattivo, m., *cattiva*, f., bad, wicked.
Certificato, certificate.
Chiaro, light, brightness, shining.
Colpo, blow, stroke.
Commedia, a comedy, play.
Condotto, f., conduct, behaviour.
Confine, *confino*, confines, frontier.
Corte, court (*uomo di corte*, courtier, formerly the court's fool).
Cosa, f., thing, matter.
Cotone, cotton (*filatoio di cotone*, cotton-mill or manufactory).
Cuore, heart.
Decreto, decree.
Diavolo, devil
Dolce, sweet, gentle, soft.
Domani, to-morrow.
Drittaccio (for *dirittaccio*), arrant knave or sly fox.
Duro, m., *dura*, f., hard, obstinate.
È, is.
Entro, within.
Estrazione, f., extraction, descent.
Fa, it is, there is.
Fede, faith, fidelity.
Femmina, female.
Ferro, iron.
Festa, feast, festival, festivity.
Fiera, fair (for merchants).
Filatoio, spinning-wheel, spinning-mill, or manufactory.
Filo, thread, wire.
Fino, m., *fina*, f., fine, thin, delicate.
Fiore, flower, bloom, prime; the most excellent or valuable part of anything; model, standard.
Fonderia, foundry.
Francoforte, Frankfort.
Galante, polite, civil; obliging, kind; gentleman-like; love-making, amorous, gallant (*galantuomo*, an upright, honest man; a man of honour, a perfect gentleman).
Garbo, pleasing address, gentility, politeness (*uomo di garbo*, a polite man; also an honest man).
Giona, Jonas.
Giorno, day.
Giuda, Judas.
Grande, great.
Grido, cry, reputation, report (*uomo*, *medico di grido*, celebrated man, physician).
Guanto, glove.
Guerra, f., war
Guglielmo, William.
Imperatore, emperor.
Importanza, importance.
Inghilterra, England.
Ispettore, inspector.
Ieri, yesterday.
Italia, Italy.
Legge, law.*
Lettera, letter (*uomo di lettere*, learned man, scholar).
Luna, moon.
Macigno, sandstone, mill-stone, stone.
Malattia, disease, illness, malady.
Male, ill, badly.
Medico, physician.
Mese, month.
Mezzo, m., *mezza*, f., (*ds*), middle, half.
Miniera, mine.
Mondo, world.
Nome, name.
Nomina, designation to office, appointment, nomination (*decreto di nomina*, diploma, commission).
Occhio, eye (*colpo d'occhio*, sight, view, prospect, instead of *ve-du-ta*).
Oggi, to-day.
Oggi giorno, nowadays.
Origine, origin, descent, birth.
Oro, gold.
Otto, eight.
Paglia, straw.
Pelle, f., skin, hide, pelt, leather.
Permesso, *congedo*, permission, leave (of absence), discharge.
Persona, person.
Piacere, pleasure (*campo di piacere*, military encampment for the diversion of the prince).
Poco, m., *poca*, f., little, small, few.
Ponte, bridge.
Poverino, poor, unfortunate.
Prodigio, prodigy, miracle.
Progetto, project, plan.
Quattro, four.
Quello, that.
Questo, this.
Reputazione, reputation, fame.
Russia, Russia.
Salute, f., health.
Sassonia, Saxony.
Sciocco, fool, blockhead.
Servo, servant.
Sette, seven.
Settimana, week.
Si, so.
Soldato, soldier.
Soprannome, surname, family name.
Soprannominato, surnamed.
Spada, sword.
Squillo, sound.
Stato, state.
Stiria, Styria.
Tabacchiera, snuff-box.
Taddeo, Thaddeus.
Taglia, a tax, a reward; shape, figure.
Talento, talent, inclination, propensity, bent, bias, will (*male talento*, malignity, maliciousness, malice, malevolence; *uomo di mal talento*, ill-natured man).
Tanto, so much.
Teatro, theatre.
Tempra, temper.
Termine, space, or point of time, period, term.
Testa, f., head.
Tintore, dyer.
Tocco, piece; touch.
Torniaio, turner.
Tre, three.
Trenta, thirty.
Tromba, trumpet.
Unito, united.
Uno, one.
Uomo, man.
Vaso, vessel, vase.
Velluto, velvet.
Venti, twenty.
Vestito, dress.
Vino, wine.
Vostro, your.

Bél-lo, m., *bél-la*, f., beautiful, handsome.
Gran-dís-si-mo, m., *gran-dís-si-ma*, f., very great, tall.
Il fí-glio, the son.
Il man-têl-lo, the cloak.
Il re-gá-lo the present, gift.
L'a-nél-lo, the ring.
La car-rôz-za (*ts*), the coach, carriage.
La cúf-fia, the cap, coif, hood (particularly for women).
La fí-glia, the daughter.
La lét-te-ra, the letter.
La ta-bac-chié-ra, the snuff-box.
L'om-brél-la, the umbrella.
L'o-ste-rí-a, the inn, hotel, tavern, public-house.
Qué-sto, m., *qué-sta*, f., this.
Ri-ce-vú-to, received, got.
Scrít-to, written.
Sú-o, m., *sú-a*, f., his, her, its.
Ven-dú-to, sold.

EXERCISE 9 (COLLOQUIAL).

Translate into English:—

1. Qué-sto ca-vál-lo è bêl-lo. 2. Qué-sta ta-bac-chié-ra è mól-to píc-co-la. 3. Quest' o-ste-rí-a è grán-de. 4. Qué-sto fan-ciúl-lo è mí-o fra-têl-lo. 5. Qué-sto tem-pe-rí-no è per mí-o fra-têl-lo. 6. La vô-stra píc-co-la so-rêl-la ha un bêl lí-bro. 7. Mí-a má-dre ha com-prá-to qué-sto cap-pêl-lo. 8. Tú-o fra-têl-lo ha ve-dú-to qué-sta bêl-la car-rôz-za. 9. Il vô-stro píc-co-lo fra-têl-lo è un buôn fan-ciúl-lo. 10. Quést' o-ro-lô-gio è mól-to buô-no. 11. Qué-sto bêll' a-nêl-lo è per qué-sto fan-ciúl-lo. 12. Mí-o zí-o ha un fí-glio ed ú-na fí-glia. 13. Ab-biá-mo ri-ce-vú-to un re-gá-lo. 14. A-vé-te vói scrít-to ú-na lêt-te-ra? 15. Mí-a so-rêl-la ha ri-ce-vú-to ú-na bêl-la cúf-fia. 16. Hai tu án-che ven-dú-to la tú-a car-rôz-za? 17. Qué-sto re-gá-lo è per vô-stra zí-a. 18. Mí-a fí-glia è gran-dís-si-ma. 19. Qué-sto pá-dre ha ú-na bêl-la fí-glia. 20. Qué-sto fan-cíul-lo è mí-o fí-glio. 21. Il giar-dí-no che hô ve-dú-to è gran-dís-si-mo. 22. Mí-o pá-dre ha per-dú-to il sú-o cap-pêl-lo e il suo om-brêl-lo. 23. Nô-stro zí-o ha ven-dú-to la sú-a bêl-la car-rôz-za.

VOCABULARY.

Are for sale, *si trô-va da vén-de-re.*
Back, *dié-tro* (adv. behind).
Beautiful, *bél-lo*, m., *bél-la*, f.
Beggar, *men-di-co*, m.
Bell, *cam-pá-na*, f.
Best, *mi-glió-re.*
Bottle, *fia-schet-ta*, f.
Boy, *ra-gáz-zo*, m.
Bridge, *pón-te*, m.
Calf, *vi-tél-lo*, m.
Cambric, *té-la ba-ti-sta*, f.
Cloth, *pán-no*, m.
Cologne, *Co-lôn-nia.*
Colour, *co-ló-re*, m.
Copper, *rá-me*, m.

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* *Lég-ge*, law, and *lég-ge*, he reads.

Dozen, *doz-zi-na* (*ds*), f
Dress, *á-bi-to*, m.
Eau, *ác-qua*, f. (water).
Edward, *E-du-ár-do*.
Fig, *fi-co*, m. (pl. *fi-chi*).
Fine, *fi-no*, m., *fi-na*, f.
From, *da*
Gold, *ô-ro*, s. m
Good, *buó-no*, m., *buó-na*, f.
Has, *ha*.
Has been prohibited, *è sta-to pro-i-bi-to*.
Has only, *ha so-la-mén-te*.
Has received, *ha ri-ce-vu-to*.
He had hidden himself, *e-gli si é-ra na-sco-sto*.
Here are, *éc-co*.
It is, *es-so e*.
Lemon, *li-mo-ne*, m.
Man, *uô-mo*, m.
Meat, *cár-ne*, f.
Once, *u-na vôl-ta*.
One, *ú-no*, m., *ú-na*, f.
Our, *nô-stro*, m., *nô-stra*, f.
Pair, *pa-io*, m.
Pound, *lib-bra*, f.
Present, *a-dês-so* (adv. now).
Ringing, *suó-no*, m.
Room, *stán-za* (or *cá-me-ra*).
Send me, *man-dá-te-mi*.
Shambles, *bec-che-ri-a*, f. (slaughter-house).
Shoe-buckle, *fib-bia*, f.
Silver, *ar-gên-to*, s. m.
Smyrna, *Smír-na*.
Some of which you wanted, *del qua-le vo-le-va-te a-vé-re*.
Spare me, *ce-de-te-mi*.
Steel, *ac-ciá-io*, s m.
Stone, *pié-tra*, s f.
Sweden, *Své-zia*.
Sword, *spá-da*, f
Taffetas, *taf-fe-ta*, m.
Ten, *dié-ci*.
They wore, *por-tá-ra-no*.
Time, *tém-po*, m.
Twelve, *do-di-ci*.
Two, *du-e*.
Use, *u-so*, m.
Velvet, *vel-lu-to*, m.
Vessel, *va-so*, m.
Waistcoat, *gi-le*, m. (pl. unaltered), *sot-to-ves-te*, f.
Watch, *o-ro-lô-gio* (*o-ri-uô-lo*).
Wether, *ca-stra-to*, m. (meat of ox, of calf, of wether).
What do you say? *che di-te?* (with the case-sign *di*).
What do you think? *che pen-sá-te?* (with the case-sign *di*).
What means? *che si-gni-fi-ca*.
Which has been sent to you, *che vi è stá-ta man-dá-ta*.
Which I have bought, *che hô com-pra-to*.
Which you have demanded, *che a-vé-te do-man-da-ta*.
Which you have received, *che a-ve-te ri-ce-vu-ti*.
Who follows him, *che gli va dié-tro*.
Whom he leads along with him, *ch' é-gli me-na se-co*.
Whom you see, *che ve-de-te*.
Wood, *lé-gno*, m.
Yard, *brac-cio*, m. (pl. *le brac-cia*, f.).
Young ox, *man-zo*, m.
Yours, *vô-stro*, m., *vô-stra*, f.

EXERCISE 10.

Translate into Italian :—

1. The present times are not the best. 2. He had hidden himself in the back room. 3. Our town has a stone bridge; yours has only one of wood. 4. Edward has received from London a gold watch, a silver sword, and a pair of steel shoe-buckles. 5. Once they wore cloth dresses and velvet waistcoats. 6. The use of copper vessels has been prohibited in Sweden. 7. What means this ringing of bells? 8. What do you say of the cloth which I have bought? 9. It is good and fine. 10. And of the colour? 11. It is beautiful. 12. Here are ten yards of the taffetas, some of which you wanted, and twelve yards of the cambric which you have demanded.

THE PARTICLE *A*.

The use of this particle frequently coincides with the use of the preposition *to* in English grammar. Generally speaking, any kind of *direction*, expressed by a verb, *to* or *towards* a person or thing, is denoted by this word. The ideas of *similarity* or *resemblance*, of *approaching* or *approximation*, of a *direction* or mere *reference* to any thing, end, aim, or point of time, form, as it were, only parts or branches of this fundamental signification of the particle *a;* and whenever the action of the subject of a sentence (*i.e.*, of the nominative) expresses such direction or approach to or towards persons or things, *a* must be placed before them. For example :—

Ac-cô-sta-ti ál-la tá-vo-la, approach thyself to the table.
Ne par-le-rò al cu-gi-no, I shall speak of it to the cousin.
Al cán-to si ri-co-nó-sce l'uc-cél-lo, by the song one knows the bird.
Í-o vá-do a Ró-ma I go to Rome.
Non cre-dé-te a-lo-ro, do not believe them.
Ag-giun-ge-re ú-na cô-sa ad un' al-tra, to add one thing to another.
Ver-ró a méz-zo gior-no, a méz-za nôt-te, ál-le dú-e, al tém-po fis-sá-to, al pri-mo del mé-se, I shall come at noon, at midnight, at two o'clock, at the appointed time, on the first of the month.

Phrases, not literally or strictly expressing an abode, residence, stay, continuance, or being in a place, but merely nearness or presence, require the particle *a* and not *in*, which always denotes a real and not merely imaginary continuance or being *in* (*i.e.*, in the interior of) a place or thing, or some action taking place in it. For example :—

É-gli è al bál-lo, he is at the ball.
A tá-vo-la, at table.
Al con-cér-to, in the concert.
A giuo-cá-re, at play or game.

To denote the moving, approaching, or tendency to or towards a place or thing, and not strictly the entering or penetrating into it, *a* and not *in* must be used; for *in* means the actual motion or penetration into the interior of any locality. For example :—

Í-o vá-do al bál-lo, I go to the ball.
A cé-na, to supper.
A im-pa-rá-re, to learn, *i.e.*, to (the pursuit of) learning.

The particle *a* may be translated by the *objective* case (without any preposition). For example :—

Fá-re ve-dé-re ad al-cú-no ú-na cô-sa, to let anyone see something.
Toc-cá-re ad al-cú-no, to concern one.
Sup-plí-re a quál-che cô-sa, to complete or make up something.

By the prepositions *to*, *at*, *on*, *upon*, *in*, *according to*, *against*, and others, as :—

Ap-pli-cár-si ad ú-na cô-sa, to apply oneself to something.
A si-ni-stra, a man-ca, to the left.
An-dá-re, ve-ni-re a un luó-go, to go, come to a place.
Pas-sá-re a fil di spá-da, to put to the sword (*i.e.*, to the edge of the sword).
Al le-vár del só-le, at sunrise.
A mi-o sén-no, to my mind, liking, taste, fancy, will.
Se-dé-re a tá-vo-la, to sit at table.
Ap-pog-giár-si a quál-che cô-sa, to lean, rest, or to depend on something.
A pié-di, a ca-val-lo, on foot, on horseback.
Ad im-prê-sti-to, on trust or credit.
Al-la sfug-gi-ta, in passing by or in flight.
Di-pin-ge-re a ô-glio, to paint in oil
Ál-la fran-ce-se, all'in-gle-se, in the French, English manner or fashion.
Di-re all'o-rec-chio, to say or whisper in anyone's ear.
A tém-po, in time, in the nick of time.
Ve-ni-re a grán-di schié-re, to come in great crowds or masses.
A ôc-chio, according to a measure taken merely by the eye.

A vo-lon-tà di cia-sche-dú-no, according to the will or liking of everybody.
Ri-bel-lár-si ad al-cú-no, to rebel or mutiny against somebody.
All'o-riên-te, all'oc-ci-dên-te, towards the east, west.
An-dá-re a gran pás-si, to walk with long strides.
Stá-re a bóc-ca a-pêr-ta, a ôc-chi a-pêr-ti, a brác-cia a-pêr-te, a cá-po chi-no, a chiô-me sciôl-te, to stand with an open or gaping mouth, with open arms, with the head inclined, with dishevelled hair.
A bri-glia sciôl-ta, with slackened reins, at full speed or gallop.
Pa-ra-go-ná-re ú-na cô-sa a quál-che altra cô-sa, to compare one thing with another.
Con-dan-ná-to a ví-ta ál-le ga-lê-re, condemned for life to the galleys.
Ês-se-re sen-sí-bi-le a quál-che cô-sa, to feel compassion for (or to be susceptible of) something.
Lo fa-rái a fôr-za, thou wilt do it by constraint.
Chiê-de-re ad al-cú-no, to ask or require of somebody.
A-vé-re a si-gnó-re, to have as a master.
A du-e a du-e, two at a time, two and two.

By adverbial *expressions* or *phrases*. For example :—

A buôn mer-cá-to, at a small price, cheap.
Ál-la pég-gio, as bad as possible.
Ál-la rin-fu-sa, confusedly, promiscuously.
A bóc-ca, by word of mouth.
Ve-ni-re ál-le má-ni, to come to blows, or to engage in close fight.

VOCABULARY.

Andate, go.
Andrete, will you go?
Arriveremo, shall we arrive?
Avvenire, the future.
Bastonata, blow (with a stick).
Bene, good.
Bristol (also *Bri-stôl-le* or *Bri-stó-lio*), Bristol.
Caccia, chase.
Caffè, coffee, coffee-house.
Cena, supper.
Cestria, Chester.
Che, what?
Chi (only of persons), who.
Collera, anger.
Concerto, concert.
Conversazione, intercourse, company, conversation.
Corte, court (of a sovereign).
Cugina (f.), cousin.
Da, from.
Di qui, from here.
Difetto, fault.
Disonore, dishonour.
Dogana, custom-house.
Domani, to-morrow.
Dormire, to sleep.
È corso, ran.
Egli, he.
Egli se lo reca, he regards or reckons it.
Egli mori, he died.
Egli lo condurra, he will bring or conduct him.
Egli è nato, he was born.
Ella giunse, she arrived.
Erano, were.
Essi, they.
Festino (dancing, gaming, etc.), evening party.
Fiorino, florin.
Firenze, Florence.
Gli vien imputata, is imputed to him.
Guadagno, profit.
Ha mandato, he has sent.
Imparare, to learn.
Io andro domani, I shall go to-morrow.
L'avete mostrato, have you shown it?
Liberalità, liberality.
Lione, Lyons.
Lo incitò, he provoked him.
Male, evil.
Mercante, merchant.
Mi, to me, me.
Molino, mill.
Noia, ennui.
Nozze (*ts*), f. pl., wedding, marriage feast.
O, or.
Ognuno, everybody.
Palazzo (*ts*), palace court.
Parola, word.
Passeggiare, to take a walk.
Pensa, thinks.
Pensate, do you think.
Penso, I think.
Pietro, Peter.
Porta, door.
Pranzo, dinner.
Preferisce, he prefers.
Presto, soon, quickly.
Prossimo (m.), *prossima* (f.), next.
Scrivere, to write.
Si venne, one (they) came.
Soggiorna, he lives or resides.
Spasso, pastime, diversion.
Straniero, stranger.
Subito, immediately.
Suo (m.), *sua* (f.), his, her.
Tira, draws, conveys.
Tirare, to draw, trail, drag; to shoot or fire, etc.
Tocca, fall to the lot or share.
Tutto, all, whole.
Uccello, bird.
Viene, comes, becomes.

EXERCISE 11.

Translate into English :—

1. Ha man-dá-to la lêt-te-ra a Gio-ván-ni. 2. Ti-rá-re ad un uc-cêl-lo. 3. Il mer-cán-te pên-sa al gua-dá-gno. 4. Dál-le pa-rô-le si vên-ne ál-le ba-sto-ná-te. 5. A chì l'a-vé-te mo-strá-to? a Piê-tro o al-la cu-gi-na? 6. A che pen-sá-te? 7. Pên-so all'av-ve-ní-re. 8. Ar-ri-ve-ré-mo prê-sto ál-la prôs-si-ma pô-sta? 9. É-gli è cór-so sú-bi-to ál-la pôr-ta. 10. Par-lá-va ad ú-no stra-niê-ro. 11. Lo in-ci-tò ál-la côl-le-ra. 12. La sú-a con-ver-sa-zió-ne mi viê-ne a nô-ia. 13. É-gli se lo rê-ca a dis-o-nó-re. 14. La li-be-ra-li-tà gli viên im-pu-tá-ta a di-fêt-to. 15. És-si ê-ra-no ál-la các-cia, ál-le nôz-ze, a prán-zo, a cé-na, al fe-stí-no. 16. Í-o an-drò do-má-ni a un bál-lo. 17. És-si ván-no a spás-so, a pas-seg-giá-re. 18. An-diá-mo al caf-fè. 19. Per dó-ve si va ál-la pô-sta? ál-la do-gá-na? 20. É-gli è a Ber-lí-no.

THE PARTICLE *DA*.

We have already stated that the particle *di* denotes a mere mental separation of ideas or notions, while the particle *da* expresses a real separation of objects. *Da* expresses any kind of tangible or mental and imaginary, but clear and real separation, removal, distance, or direction *from* a person or thing.

EXAMPLES.

Scó-sta-ti da qué-sto luô-go, begone from this place.
Al-lon-ta-ná-re ú-no da un luô-go, to remove one from a place.
L'uc-cêl-lo è u-sci-to dál-la gáb-bia the bird has flown out of the cage.
Cio (pron. *ciô*) *di-pên-de dál-la for-tú-na, da voi*, that depends on good luck, on you.
De-dúr-re ú-na ra-gio-ne da un prin-ci-pio fal-so, to deduce an argument (proof, *or* evidence) from a false principle.
Car-tá gi-ne fu fab-bri-ca-ta da Di-dó-ne, Carthage was built by Dido.
Fu é-gli da al-cú-ni suô-i se-gré-ti ne-mi-ci ac-cu-sá-to, he was accused by some of his secret enemies.

The particle *da* also is used in order, by naming the birth-place, to distinguish one person from others of the same appellation. The birth-place thus becomes, as it were, the surname of the individual.

Gio-ván-ni da Fiê-so-le, Piê-tro da Cor-tó-na, Leo-nár-do da Vin-ci, Gui-do da Siê-na, Po-li-dô-ro da Ca-ra-vág-gio, Ra-faêl-lo da Ur-bi-no, etc.

A logical contradiction and anomaly—though introduced and sanctioned by a universal usage, for the most part in the place of the preposition *a*—is the constant employment of *da* in connection with those verbs which, with some house, mansion, apartments, lodging, or any other place of continuance, denote *any kind of motion to* or *towards*, *any kind of living* or *residing with*, and *any kind of visit paid to, a person :—*

An-dá-re dal mé-di-co, dal cal-zo-lá-io, to go to the physician, to the shoemaker.
Do-má-ni ver rò da voi, I shall come to you to-morrow.
Ve-ní-te da me, dal mer-cán-te, come to me, to the merchant.
Á-bi-ta, al-lôg-gia da sú-o zí-o, he lives *or* resides with his uncle.

KEY TO EXERCISES.

Ex. 1.—1. The cloth. 2. Of the knife. 3. To the plate. 4. From the salt. 5. The aliments. 6. From the courtyards. 7. To the cooks. 8. From the dreams. 9 In theatre. 10. In the brook. 11. In the lungs. 12. With money. 13. With the pocket-handkerchief. 14. With the hats. 15. For pleasure. 16. For the cloak. 17. For the young men. 18. On the bridge. 19. On the pictures. 20 Upon this earth. 21. The footman. 22. Of the bridegroom. 23. To the stranger. 24. Of the emeralds. 25. To the writers. 26. From the printers. 27. In the mirror. 28. In the boots. 29 With study. 30. With the spirit. 31. With the sculptors 32 For the wood-cleaver. 33. For the sword-cutler. 34. Upon the rock. 35. On the benches 36. The eye. 37. Of the bird. 38 To the friend. 39. The errors. 40. Of the engravers. 41. To the ungrateful. 42. From the trees. 43. In the year. 44. With love. 45. With the dress. 46. With the wicked. 47. By deceit 48. For the workman. 49. For the flatterers. 50. On the building. 51. Upon the unhappy.

Ex 2.—1. The father and the mother. 2. The brother and the sister 3. The father is good, the mother is good. 4. The good father, the good mother. 5. The brother is good, the sister is good. 6. The good brother, the good sister. 7. My father; my good father. 8. My mother; my good mother 9. My father is good; my mother is good. 10. My brother and my sister. 11. My good brother and my good sister. 12. A father, a mother, a brother, a sister. 13. A good father, a good mother, a good brother, a good sister. 14 My father is a good father, my mother is a good mother 15. Thy father has a good sister, thy mother has a good brother.

Ex. 3.—1. Il levar del sole. 2. Lo spuntar del giorno 3. Il ritorno della primavera 4. Il calore dell'aria. 5. La bellezza del fiore. 6. L'oscurità della notte. 7. L'abisso dell'errore 8. La fertilità dei campi. 9. I colori dell'arcobaleno. 10. Il danaro è l'anima del commercio. 11. L'uso è il legislatore delle lingue. 12. Il padrone del giardino non è qui. 13. Il palazzo appartiene al principe. 14. Ecco le camere dello zio. 15. Gli abiti appartengono alla cugina, e non alla zia. 16. Il fratello dice alla sorella la volontà del padre. 17. I fanciulli devono sempre obbedire ai genitori. 18. I medici dicono, il disordine accorcia la vita. 19. Il moto giova al corpo e allo spirito. 20. La fisonomia è lo specchio dell'anima.

Ex. 4.—1. The memory. 2 To the hill. 3. From the esplanade. 4. Of the inns. 5. To the doors. 6. From the streets. 7. To one's face. 8 In the vineyard. 9. In the forests. 10. With straw. 11. With the vine. 12. With the pens. 13. Through misfortune. 14. By the valley. 15. For the follies. 16 Upon the carriage. 17. On the rocks. 18. Of the joy. 19. To the opinion. 20. The ideas. 21. Of the herbs. 22. To the arts. 23. From the cities. 24. In the imagination. 25. In the minds. 26. With water. 27. With the nail. 28. With the standards. 29 For friendship. 30. For security. 31. By the actions. 32. Upon the iron bars. 33. A child. 34 A fool. 35. Of a river. 36. From a dancer. 37. In a church 38. With a stick. 39. On a rock; upon a stone.

Ex. 5.—1. I have a book and a pen. 2 Thou hast a good book and a good pen. 3. I have a large book; my sister has also a large book. 4. Hast thou a sister? 5. I have a sister and a brother. 6. Hast thou my pen? 7. I have thy book and thy pen. 8 We have a good father and a good mother. 9. The garden is large. 10. I have a little book. 11. We have a large garden. 12. My little brother has a good book. 13. My little sister has also a good book. 14. You have a good father and a good mother. 15. Have you also a brother? 16. I have bought a good book. 17. My brother has also seen a large garden. 18. Hast thou bought a good pen? 19. I have seen thy book and thy pen. 20. Have you seen my little sister? 21. My father has bought a garden. 22. Thy sister has bought a little book.

Ex. 6.—1. L'ipocrisia è un omaggio che il vizio rende alla virtù. 2. La natura non domanda che il necessario. 3. La ragione vuole l'utile, l'amor proprio cerca il dilettevole, la passione esige il superfluo. 4. Gli alberi grandi danno più ombra che frutto. 5. Iddio è il Padre degli uomini e il Conservatore delle creature. 6. Le stelle del cielo, gli uccelli dell'aria, i pesci del mare, le piante, gli animali sono le opere del Signore. 7. La sapienza di Dio è come la luce del cielo. 8. L'ordine, la bellezza e la giocondita del mondo sono le prove manifeste d'un Essere supremo. 9. L'eccesso delle passioni è ordinariamente la cagione dell'infelicità degli uomini. 10. Il piacere dell'intemperanza e dell'incontinenza è il nemico che reca all uomo il più gran danno; esso indebolisce la sua forza, lo priva delle ricchezze e guasta il suo miglior bene, la salute.

Ex. 7.—1. The uncle's cloak. 2. John's coat. 3. My sister's house. 4. The rising, the setting of the sun. 5. Sheep's wool. 6. Point of view. 7. The house of correction. 8. One hears a pistol-shot. 9. Stone and marble quarries. 10. His masterpiece. 11. The body-guard. 12. With a single stroke of a pen. 13. A bell stroke. 14. Window-pane. 15. A garland of flowers. 16. What a blockhead thou art! 17. The knife's point. 18. A silver vein. 19. To-morrow is post-day. 20. A master of drawing, of fencing. 21. Office certificate. 22. Austrian empire. 23. Kingdom of England, of Scotland, of Ireland. 24. The city of London, of Edinburgh, of Dublin. 25. The month of January, of May. 26. The island of Sicily, of Sardinia. 27. A quarter of an hour. 28. A kind of dogs. 29. A horse-race. 30. Garrison troops

Ex. 8.—1. Il sartore domanda nove braccia di panno, due dozzine di bottoni, e mezza oncia di seta. 2. Mandate a prendere un pane di zucchero, e due libbre di caffè. 3. Io ritornerò in un quarto d'ora. 4. Finite di bere questo bicchiere di vino e mangiate questo crostino di pane. 5. Prendete la carta geografica, e cercatemi la città di Parigi e la città di Londra. 6. Io vengo per ordine del padrone a dirvi che si facciano le preparazioni per il giorno di domani. 7. Il mese d'Aprile è variabile; il mese di Maggio, incontro, è molto ameno. 8. I mesi di Dicembre e di Gennaio sono i più rigidi dell'anno. 9. Siete stati alla commedia ieri? 10. Gli aveva dato le camere di sotto.

ELOCUTION.—X.

[*Continued from p.* 232.]

IV. UNIVERSAL DECAY.

[*Marked for Rhetorical Pauses, Emphasis, and Inflections.*] *

WE receive such repeated intimations of *decay* || in the world through which we are passing;—*decline* | and *change* | and *loss follow* ' *decline* | and *change* | and *loss* || in such rapid succession that we can almost catch the *sound* of *universal wàsting*, and *hear* the work of *desolútion* ' going on *busily* ' arònd us.

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* The learner having been conducted through the application of the rules for Pauses, Emphasis, and Inflections separately, will now be prepared to study and apply them in conjunction.

"The *mountain* | falling || cometh to *nòught*, and the *rock* | is *removed* out of his *place*. The *waters* | *wear* the *stones*, the things which grow out of the *dust* of the *earth* || are *washed away*, and the *hope* of *man* | is *destroyed*." *Conscious* ' of our own *instability*, we look about ' for something to *rest* on; but we look ' in *vain*. The heavens ' and the earth | had a *beginning*, and they will have an *end*. The *face* of the *world* | is *changing, daily* and *hourly*. *All* ' *animated things* || grow *old* and *die*. The *rocks* | *crùmble*, the *trees* | *fall*, the *leaves* | *fade*, and the *grass* | *withers*. The *clouds* | are *flying*, and the *waters* | are *flowing away* from us.

The *firmest works* of *man*, too, are *gradually giving wày*: the *ivy* | clings to the *mouldering tower*, the *brier* | hangs out from the *shattered window*, and the *wall-flower* | springs from the *disjointed stones*. The *founders* | of these perishable works || have shared the *same fàte* | *long agò*. If we look back to the days of our *ancestors*, to the *mèn* | as well as the *dwellings* | of former times, they become immediately *associated* in our imaginations, and only make the feeling of instability *stronger* and *deeper* than *before*. In the spacious domes, which once held our *fathers*, the *serpent* | *hisses*, and the *wild bird* | *scrèams*. The *halls*, which once were crowded ' *with* all that *taste* | and *science* | and *labour* | could *procure*,—which *resounded* with *mèlody*, and were *lighted up* with *beauty*, are *buried* | by their *own rùins*, *mocked* | by their *own desolation*. The voice of *merriment*, and of *wailing*, the *steps* of the *busy* ' and the *idle* || have *ceased* in the *deserted courts*, and the *weeds* | *choke* the *entrances*, and the *long grass* || *waves* upon the *hearth-stone*. The *works* of *art*, the *forming hand*, the *tombs*, the very *ashes* they contained, are *all gòne*.

While we thus walk ' among the ruins of the *pàst*, a sad feeling of *insecurity* | comes over us; and that feeling ' is by no means *diminished* || when we arrive at *hòme*. If we turn to our *friends*, we can hardly *speak* to them || before they bid us *farewell*. We see them for a few *moments*, ' and in a few moments *more* their *countenances* ' are *changed*, and they are *sent away*. It matters not ' how *nèar* ' and *dear* they are. The ties which bind us together || are never too *clòse* ' to be *parted*, or too *strong* ' to be *broken*. *Tears* ' were never known to move the *king* of *tèrrors*; neither is it enough ' that we are compelled to surrender *one*, or *two*, or *màny* of those we love; for though the price is so great, we buy no *favour* with it, and our hold ' on those who remain | is as *slight* as *ever*. The *shadows* || *all elude* our *gràsp*, and follow one another ' down the valley. We gain *no confidence*, then, no feeling of *security*, by turning to our *contemporaries* and *kindred*. We know ' that the forms which are breathing *around* us, are as *shortlived* ' and *fleeting* ' as *those* were, which have been *dust* ' for *centuries*. The sensation of *vanity*, *uncèrtainty*, and *rùin*, is equally stròng, whether we muse on what has long been *prostrate*, or *gaze* on what is falling *nòw*, or *will* fall ' so sòon.

If everything | which comes under our notice || has endured for so *short* a *time*, and ' in so short a time | will be *no mòre*, we cannot say | that we receive the *least assurance* || by thinking on *ourselves*. When a *few* more friends | have *left*, a *few more* hopes | *deceived*, and a *few more changes* | *mòcked* us, "we shall be brought to the *gràve*, and shall remain in the *tomb*: the *clods* of the *valley* shall be *swèet* unto us, and *every* man ' shall *follow* us, as there are *innumerable* ' *befòre* us." *All power* ' will have *forsaken* the *stròngest*, and the *loftiest* ' will be *laid low*, and every *eye* ' will be *clòsed*, and *every voice* ' *hushed*, and *every heart* ' will have *ceased* its *beating*. And when we have gone ' *ourselves*, even our *mèmories* ' will not stay behind us *lóng*. A *few* of the near and dear || will bear our likeness ' in their *bosoms*, till *they* ' *too* ' have arrived ' at the *end* of their *jóurney*, and entered the *dark dwelling* of *unconsciousness*. In the thoughts of *óthers* || we shall live ' only till the last sound of the bell, which informs them of our *depárture*, has *cèased* to *vibrate* in their *ears*. A *stòne*, perhaps, may tell some wanderer *where* we *lie*, *whèn* we *cáme here*, and *whén* we *went away*; but ' even *that* | will soon *refuse* to bear us *record*; "*time's effacing fingers*" | will be busy on its *súrface*, and | at length ' will *wear* it *smooth*; and then | the stone itself | will *sink*, or *crumble*, and the wanderer of *anóther* age | will pass, *without* a *single call* ' upon his *sympathy*, over our *unheeded graves*.—*Greenwood*.

The following piece affords scope for "force" of utterance. In the second, third, and fourth stanzas. it rises to what is distinguished in elocution by the designation of "impassioned force"—the fullest *vehemence* of voice, bordering on the *shout*, and sometimes passing into it. This style is found chiefly in lyric poetry; but it is sometimes exemplified in the vehement energy of prose, on exciting occasions.

V. THE AMERICAN EAGLE.

[II] Bird of the heavens! whose matchless eye
Alone can front the blaze of day,
And, wandering through the radiant sky,
Ne'er from the sunlight turns away;
Whose ample wing was made to rise
Majestic o'er the loftiest peak,
On whose chill tops the winter skies,
Around thy nest, in tempests, speak,—
What ranger of the winds can dare,
Proud mountain king! with thee compare;
Or lift his gaudier plumes on high
Before thy native majesty,
When thou hast taen thy seat alone,
Upon thy cloud-encircled throne?

[I] Bird of the cliffs! thy noble form
Might well be thought almost divine;
Born for the thunder and the storm,
The mountain and the rock are thine;
And there, where never foot has been,
Thy eyrie is sublimely hung,
Where low'ring skies their wrath begin,
And loudest lullabies are sung
By the fierce spirit of the blast,
When, his snow mantle o'er him cast,
He sweeps across the mountain top,
[II] With a dark fury naught can stop,
And wings his wild unearthly way
Far through the clouded realms of day.

Bird of the sun! to thee—to thee
The earliest tints of dawn are known,
And 'tis thy proud delight to see
[II] The monarch mount his gorgeous throne
Throwing the crimson drapery by
That half impedes his glorious way;
And mounting up the radiant sky,
E'en what he is,—the king of day!
Before the regent of the skies
Men shrink, and veil their dazzled eyes;
But thou, in regal majesty,
Hast kingly rank as well as he;
And with a steady, dauntless gaze
Thou meet'st the splendour of his blaze.

Bird of Columbia! well art thou
An emblem of our native land;
[I] With unblenched front and noble brow,
Among the nations doomed to stand;
Proud, like her mighty mountain woods;
Like her own rivers, wandering free:

[II] And sending forth from hills and floods,
The joyous shout of liberty!
[I] Like thee, majestic bird! like thee,
She stands in unbought majesty,
With spreading wing, untired and strong,
That dares a soaring far and long,
That mounts aloft, nor looks below,
[II] And will not quail though tempests blow.

[I] The admiration of the earth,
In grand simplicity she stands;
Like thee, the storms beheld her birth,
And she was nursed by rugged hands:
[I] But, past the fierce and furious war,
Her rising fame new glory brings,
For kings and nobles come from far
To seek the shelter of her wings.
[I] And like thee, rider of the cloud,
She mounts the heavens, serene and proud,
Great in a pure and noble fame,
Great in a spotless champion's name,
And destined in her day to be
Mighty as Rome—more nobly free.

[I] My native land! my native land!
To her my thoughts will fondly turn;
For her the warmest hopes expand,
For her the heart with fears will yearn.
Oh! may she keep her eye, like thee,
Proud eagle of the rocky wild,
Fixed on the sun of liberty,
By rank, by faction unbeguiled;
Remembering still the rugged road
Our venerable fathers trod,
When they through toil and danger pressed,
To gain their glorious bequest,
And from each lip the caution fell
To those who followed, "Guard it well."—*Thomson.*

VI. ETERNITY OF GOD.

[*Marked for Rhetorical Pauses, Emphasis, and Inflections.*]

There is *one* Being ‖ to whom we can look | with a *perfect conviction* ˈ of *finding that security* which ˈ *nothing* about us ˈ can *give*, and which nothing about us ˈ can *take awày*. To *this* Being | we can lift up our *souls*, and on *Him* ˈ we may *rèst* them, exclaiming | in the language ˈ of the monarch of Israel, "Before the *mountains* | were brought forth, or ever Thou hadst formed the *earth* ˈ and the *wórld*, even from *everlásting* to *everlàsting* ‖ Thou art GÒD." "Of *old* ‖ hast Thou laid the foundations of the *èarth*, and the *hèavens* | are the work ˈ of Thy hands. *Thèy* | shall *pérish*, but *Thóu* | shalt *endùre;* yea, *all* of them | shall *wax old* ˈ like a *garment*, as a vèsture ˈ shalt Thou chànge them, and they shall be *chànged;* but *Thou* | art the *sàme*, and *Thy* years | shall have *no ènd*." *

Here | then | is a *support*, which will *néver fáil;* here ˈ is a *foundation* | which can *néver* be *mòved*—the *everlasting Creator* ˈ of *countless wòrlds*, "the *high* ˈ and *lofty* One | that *inhabiteth etèrnity*." What a SUBLÍME CONCÈPTION! HE INHABITS ETÈRNITY, *occupies* this *inconceivable duràtion*, PERVADES | and FILLS | THRÒUGHOUT ‖ THIS ˈ BÓUNDLESS DWÈLLING. *Ages* on *ages* ‖ before even the dust of which we are formed ‖ was *crèated*. HE had *existed* | in *infinite màjesty*, and *ages* on *ages* | will *roll away* ‖ after we have all *returned* to the dust | whence we were *táken*, and ˈ still HE will *exist* ‖ in *infinite màjesty*, *living* ˈ in the *eternity* of His *ówn nàture*, *reigning* ˈ in the *plenitude* of His *ówn omnipotence*, for *ever* sending forth the *word*, which *fórms*, *supports*, and *gòverns* ˈ *all* things, *commanding new-created light* ‖ to shine on *new-created wórlds*, and raising up *new-created generations* | to *inhàbit* them.

The contemplation ˈ of this *glorious attribute* of GÓD is fitted to excite ˈ in our minds ˈ the most *ànimating* | and *consóling* ˈ *reflèctions*. Standing as we are amid the *ruins* of *time*, and the *wrecks* of *mortálity*, where *every* thing about us | is *crèated* ˈ and *depéndent*, *proceeding* from *nothing*, and *hastening* to *destrúction*, we *rejoice* ˈ that *something* is presented to our view | which has *stood* from *everlásting*, and will *remain* for *èver*. When we have looked on the *pleasures* of *life*, and they have *vanished awáy;* when we have looked on the *works* of *náture*, and perceived that they were *chánging;* on the *monuments of árt*, and seen that they *would* not *stánd;* on our *friénds*, and they have *fled* ˈ while we were *gázing;* on *oursèlves*, and felt that *wè* were as fleeting as *théy;* when we have looked on *every* object ˈ to which we could turn our *anxious éyes*, and they have all told us that they could give us *no hope*, nor *support*, because they were so *feeble themselves;* we can look to the THRONE of GÒD: *change* ˈ and *decay* | have *never reached* THÀT; the *revolution* of *àges* ‖ has never *mòved* it; the waves of an *eternity* | have been rushing *past* it, but it has remained *unshàken;* the waves of *anòther* eternity | are rushing *tóward* it, but it is FIXED, and can NÉVER be DISTÙRBED.—*Greenwood.*

VII. THE UPRIGHT LAWYER.

[*Marked for Rhetorical Pauses, Emphasis, and Inflections.*]

In the walks of *private life*, the character of an *ùpright láwyer* ‖ shines ˈ with *mild* | but *génial* ˈ *lùstre*. He concerns himself ˈ with the beginnings of còntroversies, not to *infláme* ˈ but to *extinguish them*. He is not content ˈ with the doubtful morality ˈ of suffering clients, whose passions are rǒused, to *rush blindly* into *legal cónflict*. His conscience | can find *nó bàlm* | in the reflection, that he has but obeyed the orders of an *àngry mán*. He feels that his *first* duties | are to the *community* in which he *lives*, and whose *peace* | he is *bound* to *presèrve*.

He is no *strànger* | to the mischiefs which follow in the train of *litigàtion;* the *deadly fêuds* ˈ and *animósities* | descending from the original combatants ˈ to *successive generàtions;* the *pérjuries* ˈ and *fràuds* | so often committed to *secure success;* and the impòverishment | so commonly resulting | even to the *winning party;* and in view of *these cónsequences*, he advises to *amicable negotiátion* and *adjùstment*. He is a *pèacemaker*—a *compòser* of dissensions—a *blessing* to his *neighbourhood;* his path | is *lúminous* ‖ as the path of the JÙST.

I look ˈ with *pity* | on the man who regards himself ˈ a *mere machine* of the *làw;*—whose conceptions of moral and social duty ‖ are all absorbed in the sense of *supposed obligation* to his *client*, and this | of so low a nature ‖ as to render him a *very* TOOL ˈ and SLÀVE to serve the *worst pàssions* of men;—who yields himself ˈ a *passive instrument* ˈ of *legal inflictions*, to be moved at the pleasure of *every hirer;*—and who ‖ beholding the *ruin* and *havoc* | made by a *lawsuit*, which | "*two scruples of honesty*" | in *his counsel* | might have *prevénted*, can *calmly pocket* his *fee* | with the reflection that he has done his *duty* to his *client*, alike regardless of *duty* to his *néighbour* ˈ and his *Gòd*.

That such men *dó* exist, to *disgrace* our *proféssion*, is *lamentably trùe;* mén—

"that can speak
To *èvery* cause, and things mere *còntraries*,
Till they are *hóarse* again, yet *áll* | be LÀW."

We would *redeem* its character ‖ by marking a *higher standard* of *mòrals*. While our aid should never be withheld | from the *injured* ˈ or the *accúsed*, let it be remémbered, that all our duties ' are not concentrated in conducting an appeal to the *làw ;*—that we are not only *láwyers*, but CITIZENS | and MÈN ;—that our clients | are not always the best *judges* of their *òwn interests :*—and that ' having confided these interests to *óur* hands, it is for us to advise to *thát* course which will best conduce to their *permanent bènefit*, not merely as *solitary individuals*, but as men || connected with *society* | by *enduring ties.*—*Greenleaf.*

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* When the falling inflection recurs in succession as above, it falls lower at each repetition.

VIII. HUMAN CULTURE.

[*To be marked by the reader for Rhetorical Pauses, Emphasis, and Inflections.*]

When we see a flower—its calyx filled with petals of exquisite form, of the most delicate texture, and diverse colours, so rich and nicely blended that no art can equal them, and withal perpetually diffusing a delicious perfume, we cannot readily believe that all this variety of charms was evolved from a little seed, not bigger, it may be, than the head of a pin.

When we behold a sturdy oak that has for a hundred years defied the blasts of winter, has stretched wide around its sheltering limbs, and has seemed to grow only the more hardy the more it has been pelted by the storms,—we find it difficult to persuade ourselves that the essence, the elements of all this body and strength, were once enclosed in an acorn. Yet such are the facts of the vegetable world. Nor are they half so curious nor wonderful as the changes which are wrought by time and education in the human mind and heart.

Here, for example, is a man now master of twenty languages, who can converse in their own tongues with the people of as many different nations, whose only utterance thirty years ago was very much like, and not any more articulate than, the bleating of a lamb. Or it may be that he, who could then send forth only a wailing cry, is now overwhelming the crowded forum, or swaying the councils of the nation, by his eloquence, fraught with surpassing wisdom.

Here is another, who can conceive the structure, and direct the building of the mighty ship, that shall bear an embattled host around the world, carrying a nation's thunder; or the man, who can devise the plan of a magnificent temple, and guide the construction of it, until it shall present to the eye of the beholder a perfect whole, glowing with the unspeakable beauty of symmetrical form.

And here is a third, who has comprehended the structure of the solar system. He has ascertained the relative sizes of the planets, and learned at what precise moments they shall severally complete their circuits. He has even weighed the sun, and measured the distances of the fixed stars; and has foretold the very hour "when the dread comet," after an absence of centuries, "shall to the forehead of our evening sky return."

These men are the same beings who, thirty years ago, were puling infants, scarcely equal in their intelligence to kittens of a week old.

There, too, is a man who is swaying the destiny of nations. His empire embraces half the earth; and throughout his wide domains his will is law. At his command, hundreds of thousands rush to arms, the pliant subjects of his insatiable ambition, ready to pour out their blood like water in his cause. He arranges them, as he pleases, to execute his plans. He directs their movements, as if they were pawns upon a chess-board. He plunges them into deadly conflict, and wades to conquest over their dead and mangled bodies. That man, the despotic power of whose mind now overawes the world, was once a feeble babe, who had neither the disposition nor the strength to harm a fly.

On the other hand, there is one who now evinces unconquerable energy, and the spirit of willing self-sacrifice in works of benevolence. No toil seems to overbear his strength. No discouragement impairs his resolution. No dangers disarm his fortitude. He will penetrate into the most loathsome haunts of poverty or vice, that he may relieve the wretched, or reclaim the abandoned. He will traverse continents, and expose himself hourly to the capricious cruelty of barbarous men, that he may bear to them the glad tidings of salvation; or he will calmly face the scorn and rage of the civilised world in opposition to the wrong; or march firmly to the stake, in maintenance of the true and the right. This man, a few years ago, might have been seen crying for a sugar-plum, or quarrelling with his little sister for a twopenny toy.

And who are they that are investing society with their daring crimes, scattering about them "fire-brands, arrows, and death," boldly setting at defiance the laws of man and of God? They are the same beings that, a few years ago, were innocent little children, who, could they have conceived of such deeds of darkness, as they now perpetrate without compunction, would have shrunk from them instinctively with horror.

These, surely, are prodigious changes, greater far than any exhibited in the vegetable world. And are they not changes of infinitely greater moment? The growth of a mighty tree, from a small seed, may be matter for wonder, for admiration; but the development of a being, capable of such tremendous agencies for good or for evil, should be with us all a matter of the deepest concern. Strange, passing strange, that it is not so!—*May.*

The next piece is designed as an exercise in "smooth" and "pure quality" of voice. The *suavity* of tone, which belongs to *gentle* and *tender emotion*, should prevail in the reading of this beautiful composition. A full, clear, but softened note should be heard throughout.

IX. MEMORY.

[*pu.t.*] 'Tis sweet to remember! I would not forego
The charm which the past o'er the present can throw
For all the gay visions that fancy may weave
In her web of illusion, that shines to deceive.
We know not the future—the past we have *felt*—
Its cherished enjoyments the bosom can melt;
Its raptures anew o'er our pulses may roll,
When thoughts of the morrow fall cold on the soul.

'Tis sweet to remember! When storms are abroad,
We see in the rainbow, the promise of God:
The day may be darkened,—but far in the west,
In vermilion and gold, sinks the sun to his rest;
With smiles like the morning he passes away;
Thus the beams of delight on the spirit can play,
When in calm reminiscence we gather the flowers,
Which love scattered round us in happier hours.

'Tis sweet to remember! When friends are unkind,
When their coldness and carelessness shadow the mind.
Then, to draw back the veil which envelops a land,
Where delectable prospects in beauty expand;
To smell the green fields, the fresh waters to hear,
Whose once fairy music enchanted the ear;
To drink in the smiles that delighted us then,—
To list the fond voices of childhood again,
Oh! this the sad heart, like a reed that is bruised,
Binds up, when the banquet of hope is refused.

'Tis sweet to remember! And naught can destroy
The balm-breathing comfort, the glory, the joy,
Which springs from that fountain, to gladden our way,
When the changeful and faithless desert or betray.

I would not forget!—though my thoughts should be dark;
O'er the ocean of life, I look back from my bark,
And see the fair Eden, where once I was blest,
A type and a promise of heavenly rest.—*Clark.*

The next piece is designed as an exercise for cultivating the "orotund quality," or *full*, *round*, and *forcible* voice, which belongs to energetic and declamatory expression. A *loud*, *clear*, *ringing tone* should prevail throughout the reading or recitation of such pieces.

X. OLD IRONSIDES.

[oro.q] Ay, tear her tattered ensign down!
Long has it waved on high;
And many an eye has danced to see
That banner in the sky;
Beneath it rung the battle shout,
And burst the cannon's roar;
The meteor of the ocean air
Shall sweep the clouds no more!

Her deck,—once red with hero's blood,
Where knelt the vanquished foe,
When winds were hurrying o'er the flood,
And waves were white below,—
No more shall feel the victor's tread,
Or know the conquered knee;
The harpies of the shore shall pluck
The eagle of the sea!

Oh! better that her shattered hulk
Should sink beneath the wave;
Her thunders shook the mighty deep,
And there should be her grave:
Nail to the mast her holy flag,
Set every threadbare sail;
And give her to the god of storms,
The lightning and the gale!—*Holmes.*

The following piece is designed for practice in the "slow" utterance which characterises the tones of *sublimity* and *awe*. The "rate" of voice is not altogether so slow as will be required in some pieces; yet it retains much of that effect which cannot be given without slowness of movement and full pauses. The note, in the style of this lesson, continues *low*, although *not* so remarkably *deep* as in the preceding. The principal object of practice, in this instance, is to secure that degree of "slowness" which marks the tones of *wonder* and *astonishment*.

XI. NIAGARA.

Flow on for ever, in thy glorious robe
Of terror and of beauty! Yea, flow on
Unfathomed and resistless! God hath set
His rainbow on thy forehead: and the cloud
Mantled around thy feet. And He doth give
Thy voice of thunder, power to speak of Him
Eternally,—bidding the lip of man
Keep silence, and upon thy rocky altar pour
Incense of awe-struck praise.

Ah! who can dare
To lift the insect-trump of earthly hope,
Or love or sorrow, 'mid the peal sublime
Of thy tremendous hymn? E'en Ocean shrinks
Back from thy brotherhood; and all his waves
Retire abashed. For he doth sometimes seem
To sleep like a spent labourer, and recall
His wearied billows from their vexing play,
And lull them to a cradle calm; but thou
With everlasting, undecaying tide,
Doth rest not, night or day. The morning stars,
When first they sang o'er young creation's birth,
Heard thy deep anthem; and those wrecking fires
That wait the archangel's signal to dissolve
This solid earth, shall find Jehovah's name
Graven as with a thousand diamond spears,
On thine unending volume.
Ev'ry leaf,
That lifts itself within thy wide domain,
Doth gather greenness from thy living spray,
Yet tremble at the baptism. Lo!—yon birds
Do boldly venture near, and bathe their wing
Amid thy mist and foam. 'Tis meet for them
To touch thy garment's hem, and lightly stir
The snowy leaflets of thy vapour wreath,
For they may sport unharmed amid the cloud,
Or listen at the echoing gate of heaven,
Without reproof. But, as for us, it seems
Scarce lawful with our broken tones, to speak
Familiarly of thee. Methinks to tint
Thy glorious features with our pencil's point,
Or woo thee to a tablet of a song,
Were profanation
Thou dost make the soul
A wondering witness of thy majesty;
But as it presses with delirious joy
To pierce thy vestibule, dost chain its step,
And tame its rapture with the humbling view
Of its own nothingness; bidding it stand
In the dread presence of the Invisible,
As if to answer to its God through thee.—*Sigourney.*

ACOUSTICS.—I.

INTRODUCTION—DIFFERENCE BETWEEN SOUND AND NOISE—SOUND PRODUCED BY VIBRATIONS—HOW CONVEYED TO THE EAR—CONDUCTION OF SOUND—TELEPHONIC CONCERT—THE TELEPHONE AND PHONOGRAPH—CAUSES AFFECTING INTENSITY—CONSONANCE AND INTERFERENCE.

THE science of Acoustics, on the study of which we are now about to enter, is concerned with inquiries as to the nature and properties of sound. In the human body a special nerve, called the *auditory nerve*, proceeds from the brain and spreads out into a number of minute filaments, which are distributed over the surface of one of the cavities of the ear. When any elastic substance is put in rapid vibration, it causes certain tremors or vibrations of the air around; these are conveyed to the ear, and acting upon this nerve give rise to the sensation of sound.

Sounds are very varied in character, and the science of music treats of the relations subsisting between some of them and the effects they produce upon the emotions. Acoustics is merely occupied with ascertaining the nature and causes of different sounds.

Whenever the air or any elastic body is set in vibration, a sound will be produced, provided that the vibrations be sufficiently rapid: if they are too slow, the ear will be unable to distinguish the sound; different ears have, however, different powers in this way, as will be explained shortly. The simplest illustration of this fact is seen by fixing one end of a string to a hook (Fig. 1), and suspending a weight from its lower end, at the same time limiting the motion of the cord by means of a ring, A. If, now, the cord be plucked near the middle by the finger and thumb, it will be set in vibration, forming the curves shown by the dotted lines; at the same time a distinct musical note or *tone* will be produced. These vibrations will gradually diminish in amplitude, and the sound will become weaker and weaker till it ceases. Sound, then, is the result of vibrations of sufficient rapidity and amplitude to be audible The *pitch* of the note depends upon various causes which will hereafter be explained.

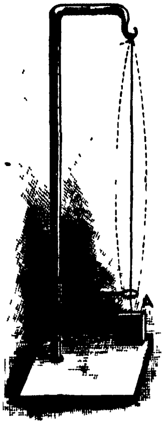

Fig. 1.

Frequently, however, a sound is produced which is not a musical tone, but is called a noise, as, for instance, when we rattle pieces of metal in a box, or let a weight fall to the ground. What, then, is the difference between the two? When the vibrations succeed one another in a regular and uniform manner, as in the case of a vibrating string or wire, a musical sound or tone is produced; but when the vibrations are not isochronous, or when a single explosive disturbance of the air is produced—as, for instance, by a sudden blow or the report of a pistol—or when several sounds interfere with one another so as to produce confused waves in the air, in any such cases a noise is the result.

If we examine a few sounding bodies, we can easily satisfy ourselves that in every case their particles are thrown into a state of rapid vibration. This is easily seen in the case of a flat plate on which sand or light powder has been sprinkled; the dust is agitated by the vibrations of the plate and forms itself into regular figures, the cause of which we will explain later on.

The same effect can also be shown by means of the apparatus represented in Fig 2 A glass bell is fixed to a stand, and beside it is a stand carrying a small ivory ball. This is so arranged that the ball shall just rest against the rim of the glass. Now let a violin bow be rubbed with a lump of rosin, and then drawn steadily over the edge of the glass. A clear musical note will be produced, but the vibrations of the glass will scarcely be perceptible to the eye. The ivory ball will, however, at once act as a tell-tale, for it will be violently agitated and will swing away from the glass; and the louder the note produced, the greater will be the amount of its oscillation. If a sharp style be brought nearly into contact with the glass a series of taps will be heard, caused by the bell striking against the point as it vibrates. By lightly touching the glass we can feel the vibrations.

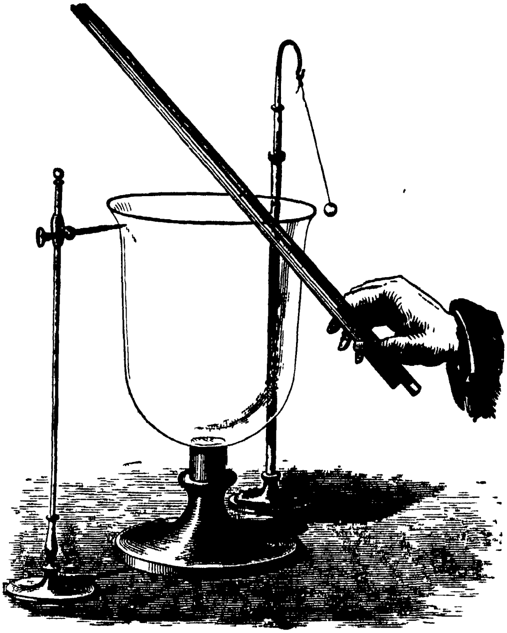

Fig. 2

Another very good illustration may be obtained in the following way:—

If a light strip of steel is firmly gripped at one end in a vice (as shown in Fig. 3) and the other end plucked aside, it will, when let go, vibrate backwards and forwards as shown; and if the vibrations are sufficiently rapid, a musical note will be produced. We may explain, in passing, the meanings which are generally attached to the terms, *vibration*, *amplitude*, etc. The motion from one end (D′) of the path to the other end (D″) ***and back*** is called a *complete vibration*—sometimes a double vibration—and the time occupied in moving over this distance is called the periodic time of the vibration. French writers usually designate as one vibration a half or single vibration. The *amplitude* of the vibration of any point is the distance of one extreme position from the mean position.

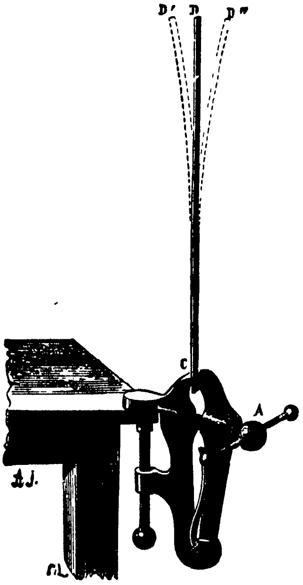

Fig. 3.

We have seen how sound is produced by vibrations. It may be well to inquire now, in what way the vibrations which are thus produced are propagated through the air so as to reach our auditory nerves. The particles of air immediately around the vibrating body are not driven right away so as to strike the tympanum of the ear. Each one is moved a slight distance from its original position, to which, however, it immediately returns, and then recedes almost as far in the other direction. These particles, however, impart a similar oscillating movement to those lying beyond them, which in their turn communicate the movement, and thus the waves produced are conveyed from particle to particle, and travel widely and rapidly.

If we fix one end of a long rope or cord to a staple in a wall, and, holding the other end in the hand, shake it, waves will appear to travel from the hand to the staple and back again. We know, however, that in reality each portion of the cord merely moves up and down in an almost straight line, and the successive movements of the single portions produce the appearance of a wave—the wave, or *pulse*, travelling along the cord though the particles of the cord itself do not travel in that direction. This gives a good idea of the mode in which sound-waves are propagated by the oscillations of different layers of air.

By standing at the head of a pier, and watching the waves rise and fall in the sea, we get a further illustration of the same fact. They appear to be travelling along and coming ashore in rapid succession; but if we drop a piece of wood on the surface in a part where it is not affected by the breaking of the waves against the pier, we shall find that it scarcely moves along at all, but merely rises and falls on the surface.

So, too, if we drop a stone into the middle of a pond of water whose surface is quite calm, we shall see the waves produced by it gradually enlarging and spreading in all directions towards the sides. As, however, they recede and become wider, they diminish in height, till in a large pond they are quite lost. In just the same way a bell or any sounding body produces waves in the air around it, which extend farther and farther, diminishing in intensity as they travel, till at last they become too faint to affect the ear, or else are overpowered by the multitudes of other vibrations which exist in the air.

By taking a shallow rectangular vessel of water, and watching the waves produced in it when we touch its surface, we shall be able to understand many things in connection with the diffusion and reflection of sound that would otherwise appear difficult.

A moment's consideration will easily show us why it is that a sound diminishes so rapidly in intensity as we recede from the sounding body. Since the waves are propagated equally in all directions, it is clear that the mass of air set in vibration increases very rapidly; the original vibration has therefore to be spread over a much larger area, and its intensity is diminished in the same proportion; in fact in the *inverse ratio of the square of the distance* which the disturbance has been propagated.

From this we see that it is necessary to have some substance to convey the vibrations from the vibrating body to the ear. If the atmosphere were entirely removed, no sound would ever reach us; all would be continual unbroken silence. We can easily obtain an experimental illustration of this fact. An alarum (Fig. 4), made so as to continue striking for some little time, is placed under the receiver of an air-pump, a layer of wadding being placed between it and the pump-plate to prevent the vibrations being communicated to the air in that way. It is now set in action, and the pump rapidly worked; as the air under the receiver becomes more and more rarefied the sound becomes feebler and feebler, till at last it almost entirely ceases, though we can see that the hammer still continues to strike on the bell. A better way of performing the experiment is to suspend the alarum by means of threads from four supports, as in this way all the vibrations are kept from the pump-plate. A rod is provided which passes air-tight through the top of the receiver, and by pressing this down a detent can be moved, so as to stop or start the bell at pleasure. When a nearly perfect vacuum is attained, no sound whatever will be heard, even when the ear is applied closely.

Now admit hydrogen gas into the receiver in place of common air, and allow the alarum to strike as before; the sound will be heard, but it will be faint and peculiar in tone. If we inhale hydrogen gas (which for this purpose must be quite pure), and then attempt to speak, the voice likewise will be found greatly changed in character, having become hollow and thin, at the same time being considerably higher than usual, so as to resemble a squeak. We see, then, that the intensity of any sound depends upon the density of the air in which it is generated rather than of that in which it is heard.

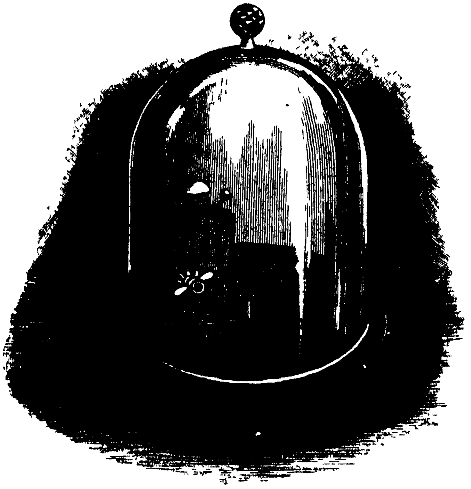

Fig. 4.

When at great elevations on the sides of mountains, all sounds are wonderfully diminished in intensity in consequence of the rarefied state of the air. Saussure says that on the summit of Mont Blanc the report of a pistol was not louder than that of an ordinary cracker, and the travellers were obliged to speak in a louder tone than usual in order to be heard.

The rate at which the sound-wave travels through the air does not depend at all upon the intensity or the pitch. If it did, music when heard at a little distance would be quite changed into discord, since the louder notes would outstrip the others.

In the case, however, of extremely loud sounds, such as, for instance, the report of a heavy piece of ordnance, there seems to be a slight departure from this law.

Sound is conducted by liquids or solids, as well as by gases. When two stones are struck together under water, the sound is conveyed a considerable distance. Divers, too, can communicate with those on the surface by striking the sides of the diving-bell with a hammer or stone. If a watch be laid upon one end of a plank, and the ear applied to the other, the ticking will be heard much farther off than it would otherwise be. In a similar way the earth acts as a conductor of sound, for if the ear be applied to its surface, the footsteps of men or horses approaching may be heard at a very great distance. So, too, by laying the ear upon the metal rails, the sound caused by the wheels of a train can be heard much farther off than it can by any person merely standing up and listening.

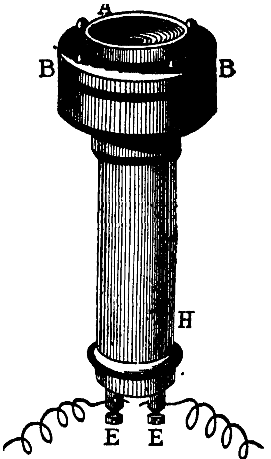

Fig. 5.

Many very interesting experiments can be tried to illustrate the conduction of sound. One of the simplest is to suspend a common poker by a piece of string or list. Wind the ends of this round the forefinger of each hand, and having put the fingers into the ears, make the poker swing so as to strike against the fender or some piece of metal. Instead of the sound usually heard we shall now hear one almost resembling that of a church bell. The vibrations are conveyed so much more plentifully along the string than through the air, that the sound is very greatly increased in intensity, and is heard for a longer period.

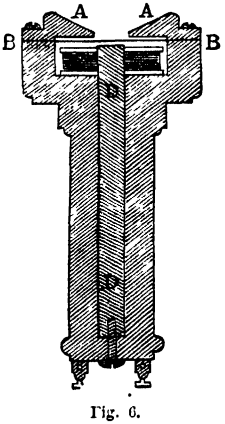

Fig. 6.

In a similar way we can easily conduct sound from place to place, Let a thin wooden rod some twelve or fifteen feet long be rested on the tips of the fingers of two people, and against one end of it let there be held a thin sounding-board, or a box of thin wood, or, better still, a violin. Now strike a tuning-fork, and place it against the other end of the rod. The sound will at once fill the room, but will appear to proceed, not from the tuning-fork, but from the sounding body at the other end of the rod. Every vibration of the former is conveyed along the rod, and accurately reproduced at the other end. It is heard much more distinctly there because it is distributed over the surface of a large sounding body, and thus the waves of sound produced are much more distinct. If two forks sounding different notes be struck and placed together at the end, both sounds will be conveyed along the rod, the vibrations of the one appearing not to interfere with those caused by the second.

A very interesting modification of this experiment was introduced by Professor Wheatstone at the London Polytechnic Institution some years ago, and has been many times repeated since. It was an arrangement known as the Telephonic Concert.

Long deal rods were made to pass up from the basement of the building through the different ceilings to the floor of the lecture hall, above which they projected a little distance. The lower ends of these were made to rest upon various musical instruments; the end of one being pointed and made to rest upon the sounding-board of a piano, while another was in contact with a violin, and so on. On the upper ends of these rods harps were placed so that the rods were in contact with their sounding-boards. They were, however, so arranged that they could very easily be removed from the rods when necessary. A gentle tap conveyed to the performers below intimation that all was ready, and every sound emanating from the instruments was faithfully conveyed along the rods, and appeared to issue from the harps resting upon them. It can easily be understood what a strange effect was produced by the sound of a piano, violin, or other musical instrument appearing in this way to issue from a harp, especially as no performers could be seen. If the harp were moved at all, so as to break the contact between it and the rod, every sound at once ceased, though the performers still continued to play upon the various instruments. On renewing contact the sound continued as before. The experiment is a very remarkable one, all the different vibrations produced by the various wires of the piano being conveyed along the one rod without interfering at all with one another.

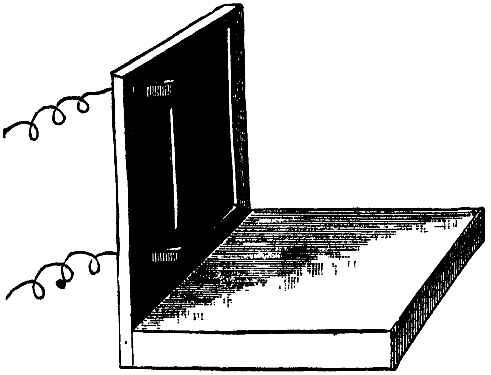

Fig. 7.

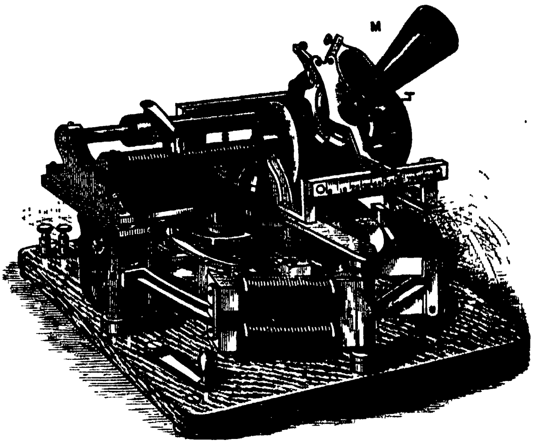

Fig. 8.

The experiment has been carried even further than this. The attempt was made to convey the music of the human voice in the same way. The performers were placed with their mouths very close to a sounding-board connected with the rod, and, as they sang, the music was conveyed along the rod, and produced the remarkable phenomenon of the singing harp. The success of this experiment was even more complete than could have been anticipated. The performers were obliged to be so close together, and to remain in such a ludicrous and confined position, that often they bumped their heads together, and the music ended in a peal of laughter, which was of course reproduced by the harp, to the no small astonishment of the audience.

Many of our readers may have seen other entertainments which illustrate the principle we have been referring to.

In the Telephone as invented by Graham Bell in 1876, and now so much used, an entirely different method of transmitting sound is employed. In this case the vibrations of a thin metallic disc, against which the air from the speaker's mouth impinges, induce electric currents in a conducting wire, these currents producing similar vibrations in the disc of the receiving instrument at the other end of the line. Figs. 5 and 6 give a perspective and a sectional view of the instrument, in which B B is the disc referred to tightly clamped in front of the mouthpiece A A, D being a steel magnet and C. the coil of wire in which the current is induced.

The **MICROPHONE** of Professor Hughes, shown in outline in Fig. 7, serves as a relay to magnify minute sounds, the principle being similar to that of the telephone. It, in fact, plays much the same part in acoustics that the microscope does in optics.

EDISON'S PHONOGRAPH is remarkable in tracing a record of sounds produced either by the human voice or musical instruments; these records can in their turn reproduce the original sounds. The instrument is shown in Fig. 8. It consists of a wax cylinder which can be driven at a constant speed by an electro-motor. A light style, attached to a disc somewhat resembling the disc of a telephone, cuts a minute spiral furrow in the rotating cylinder, at the same time leaving indentations corresponding with the sounds received. This cylinder when rotated at any future time can, in its turn, actuate the style and disc, and thus communicate to the air sounds resembling those which produced the record. This forms one of the most modern and wonderful proofs yet adduced of the fact that certain vibrations of the air communicate to our ears certain definite sounds.

It is not necessary to refer to the great utility of such an arrangement or to the many ways in which this great invention of *recording* vibrations for future reproduction may be of service to mankind.

We may now collect and review the main causes which influence the intensity of any sound.

The first, as has already been explained, is the distance of the sounding body from the ear, the sound being found to diminish in intensity inversely as the square of the distance; that is, a sound when heard at double the distance has only one-fourth the intensity.

Another cause is the density of the air in which the sound is produced. This is shown by the bell under the exhausted receiver. As air is gradually admitted, the sound becomes more and more distinct; and if the receiver be filled with carbonic acid gas, the density of which is half as great again as that of air, the sound will be rendered much more intense.

The intensity of any sound is further dependent upon the amplitude or extent of the vibrations of the sonorous body. When a stretched cord is first plucked or struck, its vibrations are much more extensive than they are when the sound grows fainter. So, too, if a tuning-fork (Fig. 9) be violently struck, the sound will gradually become feebler as the vibrations of the limb become more and more limited.

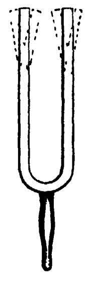

Fig. 9.

The next cause to which we must refer is the motion of the atmosphere and the direction of the wind. On a calm day sound is always conveyed better than when the air is disturbed. A gentle wind, too, causes the sound to be more intensely heard in the direction in which it is blowing.

The proximity of a sonorous body also serves to increase the power of sound. Illustrations of this are to be met with in the case of musical instruments, and sounding-boards used in conjunction with tuning-forks, and we shall have occasion to refer to others as we proceed.

These statements may be more easily remembered if put in the following concise shape:—

1. Intensity varies inversely as the square of the distance.
2. Intensity varies directly as the square of the amplitude of the vibrations.
3. Intensity increases with the density of the medium.
4. Intensity is modified by the condition of the air.
5. Intensity is modified by the proximity of a sonorous body.

We cannot better close the present lesson than by alluding to the remarkable property which the vibrations of sound—especially of a regular or musical kind—have of communicating similar vibrations to bodies in their neighbourhood. The effect thus produced is due to what is called *consonance*. A tuning-fork immediately takes up the vibrations of another which is in unison with it. A string or an organ-pipe will reinforce the sound of a corresponding tuning-fork held near it.

Interference of Sound.—Just as two similar sound-waves *reinforce* each other, so two dissimilar waves—of unequal period or different phase—will oppose each other. If, however, the periods are but slightly unequal, alternate reinforcement and interference will result, and ***beats*** will be produced. Thus, if one wave of sound makes, say, nine and another ten complete vibrations in any given interval of time, there will be a certain point or points at which the two waves will agree, and a reinforcement of the sound or a ***beat*** will be produced. Dr. Koenig, of Paris, whose elaborate researches on the physical basis of music have recently been summarised in an excellent lecture by Dr. Silvanus P. Thompson*, finds that when two simple tones are simultaneously sounded, there are primary beats as well as beats of secondary and higher orders; also when two simple tones interfere, the *primary* beats belong to one or other of two sets corresponding respectively in number to the two remainders *positive* and *negative* found by dividing the frequency of the higher tone by that of the lower. Thus if two tones are sounded one of 74 and the other of 40 vibrations per second, we get the remainders 34 and — 6, by dividing 74 by 40, in other words 40 goes into 74 once with a (positive) remainder 34, but it also requires only six to be added to the 74 in order that it may go into it twice. Hence the ear can distinguish two sets of beats, one rapid at 34 per second and the other slow at 6 per second. We may have occasion to refer to these interesting researches later on.

GERMAN.—XXXV.

[*Continued from p. 244.*]

PARADIGMS OF THE AUXILIARIES OF THE FIRST CLASS (*continued*).

(3) Werden, *to become.*

INDICATIVE MOOD.

	PRESENT.		PAST.
Sing.	Ich werde, I become.	*Sing.*	Ich wurde, I became.
	Du wirſt.		Du wurdeſt.
	Er wird.		Er wurde.
Plur.	Wir werden.	*Plur.*	Wir wurden.
	Ihr werdet.		Ihr wurdet.
	Sie werden.		Sie wurden.

	PRESENT PERFECT.		PLUPERFECT.
Sing.	Ich bin geworden, I have become.	*Sing.*	Ich war geworden, I had become.
	Du biſt geworden.		Du warſt geworden.
	Er iſt geworden.		Er war geworden.
Plur.	Wir ſind geworden.	*Plur.*	Wir waren geworden.
	Ihr ſeid geworden.		Ihr waret geworden.
	Sie ſind geworden.		Sie waren geworden.

	FUTURE IMPERFECT.		FUTURE PERFECT.
Sing.	Ich werde werden, I shall become.	*Sing.*	Ich werde geworden ſein, I shall have become.
	Du wirſt werden.		Du wirſt geworden ſein.
	Er wird werden.		Er wird geworden ſein.
Plur.	Wir werden werden.	*Plur.*	Wir werden geworden ſein.
	Ihr werdet werden.		Ihr werdet geworden ſein.
	Sie werden werden.		Sie werden geworden ſein.

SUBJUNCTIVE MOOD.

	PRESENT.		PAST.
Sing.	Ich werde, I may become.	*Sing.*	Ich würde, I might become.
	Du werdeſt.		Du würdeſt.
	Er werde.		Er würde.
Plur.	Wir werden.	*Plur.*	Wir würden.
	Ihr werdet.		Ihr würdet.
	Sie werden.		Sie würden.

	PRESENT PERFECT.		PLUPERFECT.
Sing.	Ich ſei geworden, I may have become.	*Sing.*	Ich wäre geworden, I might have become.
	Du ſeieſt geworden.		Du wäreſt geworden.
	Er ſei geworden.		Er wäre geworden.
Plur.	Wir ſeien geworden.	*Plur.*	Wir wären geworden.
	Ihr ſeiet geworden.		Ihr wäret geworden.
	Sie ſeien geworden.		Sie wären geworden.

	FUTURE IMPERFECT.		FUTURE PERFECT.
Sing.	Ich werde werden, (if) I shall become.	*Sing.*	Ich werde geworden ſein, (if) I shall have become.
	Du werdeſt werden.		Du werdeſt geworden ſein.
	Er werde werden.		Er werde geworden ſein.
Plur	Wir werden werden.	*Plur.*	Wir werden geworden ſein.
	Ihr werdet werden.		Ihr werdet geworden ſein.
	Sie werden werden.		Sie werden geworden ſein.

CONDITIONAL MOOD.

	FUTURE IMPERFECT.		FUTURE PERFECT.
Sing.	Ich würde werden, I should become.	*Sing.*	Ich würde geworden ſein, I should have become.
	Du würdeſt werden.		Du würdeſt geworden ſein.
	Er würde werden.		Er würde geworden ſein.
Plur.	Wir würden werden.	*Plur.*	Wir würden geworden ſein.
	Ihr würdet werden.		Ihr würdet geworden ſein.
	Sie würden werden.		Sie würden geworden ſein.

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* Delivered at the Royal Institution on June 13th, 1890.

IMPERATIVE MOOD.

PRESENT.

Sing. Werde (du), become thou.
Werde er, let him become.
Plur. Werden wir, let us become.
Werdet (ihr), become ye.
Werden ſie, let them become.

INFINITIVE MOOD.

PRESENT.	PERFECT.	FUTURE.
Werden, to become.	Geworden ſein, to have become.	Werden werden, to be about to become.

PARTICIPLE.

PRESENT.	PAST.
Werdend, becoming.	Geworden, become.

AUXILIARIES OF THE SECOND CLASS.

The second class of auxiliaries embraces the following:—

Ich mag, I am allowed (may).
Ich will, I will (purpose).
Ich ſoll, I am obliged (shall).
Ich kann, I am able (can).
Ich darf, I am permitted; I dare.
Ich muß, I am obliged (must).
Ich laſſe, I let.

These verbs are, for the most part, very irregular in conjugation, and serve simply the purpose of modifying other verbs with the ideas of *liberty*, *possibility*, or *necessity*, and the verbs thus modified are required to be in the infinitive mood: thus, Er mag lachen, he *may* (has permission to) laugh; Ich kann ſchreiben, I *can* (am able to) write; where lachen and ſchreiben are both in the infinitive, governed respectively by mag and kann.

In the perfect and pluperfect tenses, however, the past participle of these verbs is used only when the principal verb is not expressed. Its place is supplied in such cases by the infinitive, the translation, of course, being the same in either case, as:—

Ich habe ihn ſehen können (instead of gekonnt), I have been able to see him.

Er hat warten müſſen (instead of gemußt), he was obliged to wait.

Man hätte über ihn lachen mögen (instead of gemocht), one might have laughed at him.

Er hat dem Befehle nicht gehorchen wollen (instead of gewollt), he has not been willing to obey the command.

Ich habe ſein Geheimniß wiſſen dürfen (instead of gedurft), I have been allowed to know his secret.

Sie hätten es thun ſollen (instead of geſollt), they ought to have done it.

Sie haben ihn gehen laſſen (instead of gelaſſen), they have suffered him to go.

The verb laſſen (*to let*) does not belong to the Mixed Conjugation. This verb is used either in *permitting* or *commanding*, as:—Ich habe ihn gehen laſſen, I have *allowed* him to go; Ich habe ihn kommen laſſen, I have *ordered* him to come; which two meanings are near akin. When used with a reciprocal pronoun, it has its equivalent in such phrases as *can, is to, ought to, may;* as:—Das läßt ſich nicht thun, that cannot be done (lit. *does not allow itself* to be done). The infinitive active after laſſen must often be translated passively.

CONJUGATION OF VERBS.

There are two conjugations of verbs—the *Old*, or Strong, and the *New*, or Weak. The difference between them lies mainly in the mode of forming the past tense and the past participle.

The verbs of the Old Form are commonly denominated *Irregular Verbs*. But as nearly all the primitive verbs in the language are conjugated in this way, and few, except the derivative verbs (now the larger class), ever assume the other form, it is the custom of the best German grammarians to adopt the classification which we have given. This will occasion no confusion or inconvenience to those who prefer the common classification; since it is only necessary to remember that the *things* are the same, though the *names* have been changed.

In order to afford the ready means of comparing the *terminational* differences between the Old and New forms of conjugation, we subjoin the following tabular view of the *simple tenses* and *participles*, in which alone differences of this kind can exist.

In the compound tenses, the *auxiliary* alone being subjected to terminational variation, the mode of inflecting these tenses becomes of course perfectly uniform in all classes of verbs. Hence, to secure a complete acquaintance with the forms of the compound tenses, little more is necessary than a bare inspection of the paradigms.

You will observe that many of the same verbs belong to the old or strong conjugation in German, which are also irregular in English. For the most part they are verbs which convey simple and necessary ideas, and which were in consequence a part of the language at an early stage of its development. Compare, for instance, *give, gave, given* with geben, gab, gegeben, and you will see that the verbs undergo a precisely similar vowel change in English and German.

Terminations of the Simple Tenses.

Old Conjugation.

			INDICATIVE.			SUBJUNCTIVE.		
		Persons.	*Root.*	*Tense-Sign.*	*Personal Ending*	*Root.*	*Tense-Sign.*	*Pers. Ending.*
Present.	*Sing.*	1	—	*wanting.*	-e	—	*wanting.*	-e
		2	—		-eſt, -ſt	—		-eſt
		3	—		-et, -t	—		-e
	Plur.	1	—		-en, -n	—		-en
		2	—		-et, -t	—		-et
		3	—		-en, -n	—		-en
Past.	*Sing.*	1	—	*wanting.*	—	—	*wanting.*	-e
		2	—		-eſt, -ſt	—		-eſt
		3	—		—	—		-e
	Plur.	1	—		-en	—		-en
		2	—		-et	—		-et
		3	—		-en	—		-en

			IMPERATIVE			INFINITIVE.	
		Persons.	*Root.*	*Tense-Sign.*	*Personal Ending.*	*Root.*	*Ending.*
Present.	*Sing.*	1	—	*wanting.*	—	—	-en
		2	—		-e		
		3	—		-e		
	Plur.	1	—		-en		
		2	—		-et, -t		
		3	—		-en		

PARTICIPLE.	
Present.	*Past.*
-end	ge-en

New Conjugation.

			INDICATIVE.			SUBJUNCTIVE.		
		Persons.	*Root.*	*Tense-Sign.*	*Personal Ending.*	*Root.*	*Tense-Sign.*	*Pers. End.*
Present.	*Sing.*	1	—	*wanting.*	-e	—	*wanting.*	-e
		2	—		-eſt, -ſt	—		-eſt
		3	—		-et, -t	—		-e
	Plur.	1	—		-en, -n	—		-en
		2	—		-et, -t	—		-et
		3	—		-en, -n	—		-en
Past.	*Sing.*	1	—	t or et	+ e	—	t or et	+ e
		2	—	t or et	+ eſt	—	t or et	+ eſt
		3	—	t or et	+ e	—	t or et	+ e
	Plur.	1	—	t or et	+ en	—	t or et	+ en
		2	—	t or et	+ et	—	t or et	+ et
		3	—	t or et	+ en	—	t or et	+ en

			IMPERATIVE.			INFINITIVE.	
		Persons.	*Root.*	*Tense-Sign.*	*Personal Ending*	*Root.*	*Ending.*
Present.	*Sing.*	1	—	*wanting.*	—	—	-en
		2	—		-e		
		3	—		-e		
	Plur.	1	—		-en		
		2	—		-et, -t		
		3	—		-en		

PARTICIPLE.	
Present.	*Past.*
-end	ge-et or t

Remark.—The sign + in the table above is used as in arithmetic, *i.e.*, to indicate that the parts et + e are to be united: as, ete

Observations on the Preceding Table.

Observe in the table above that the terminations in all places, except the past of the New Form, are to be added *directly* to the root. In the place excepted (*past of the New Form*), there comes between the root and the personal ending a sort of ***tense-sign*** (et or t), which is not necessary to verbs of the Old Form, because in ***them*** the past is made by means of a change in the radical vowel.

It may also be noticed that a characteristic difference in *form* between the indicative and the subjunctive (third person singular) is, that the former ends in -et or -t, the latter always in -e; and that the ***personal ending*** in the first and third person singular of the past of the *Old Form* is wholly omitted.

It may further be observed that the e in the terminations -eſt and -et of the indicative is retained or omitted just according to what is demanded by euphony. In the subjunctive, for the most part, the full termination is preserved.

For the same reason, also (that is, for the sake of euphony), when the root of a verb ends in el or er, the vowel e of any termination beginning with that letter is commonly omitted, as:—Hämmern (not hämmeren), to hammer; ſammeln (not ſammelen), to collect). Sometimes, however, the e of the ***root*** is rejected, as:—Ich ſammle (not ſammele), I collect.

Verbs of the Old Conjugation.

(Commonly called Irregular Verbs.)

In the Old Conjugation, the past tense and the past participle are distinguished from the infinitive chiefly by a change of the radical vowels.

Thus, in some verbs, a different radical vowel is found in each of these three parts :—

Infinitive.	*Past.*	*Past Participle.*
Bitten, beg ;	bat, begged ;	gebeten, begged.
Helfen, help ;	half, helped ;	geholfen, helped.
Sinnen, reflect ;	ſann, reflected ;	geſonnen, reflected.
Trinken, drink ;	trank, drank ;	getrunken, drunk.

When in the course of the changes noted in the text above, a long vowel or diphthong becomes *short*, the final consonant of the root is doubled, as :—

Reiten, to ride ;	ritt, rode ;	geritten, ridden.
Leiden, to suffer ;	litt, suffered ;	gelitten, suffered.

In the case of leiden, note also that d is changed into its cognate t. When, on the other hand, a short vowel is thus made *long*, the second of two radical consonants is omitted :—

Bitten, to beg ;	bat, begged ;	gebeten, begged.
Kommen, to come ;	kam, came ;	gekommen, come.

In some, the vowel or diphthong in the past and the participle is the same, but is different from that in the infinitive, as :—

Glimmen, glimmer ;	glomm, glimmered ;	geglommen, glimmered.
Heben, lift ;	hob, lifted ;	gehoben, lifted.
Leiden, suffer ;	litt, suffered ;	gelitten, suffered.
Saugen, suck ;	ſog, sucked ;	geſogen, sucked.
, shove ;	ſchob, shoved ;	geſchoben, shoved.
n, write ;	ſchrieb, wrote ;	geſchrieben, written.

In others, the vowel or diphthong of the infinitive is changed in the past, but resumed in the participle, as :—

Blaſen, blow (sound).	blies, blew ;	geblaſen, blown.
Geben, give ;	gab, gave ;	gegeben, given.
Hangen, hang ;	hing, hung ;	gehangen, hung.
Kommen, come ;	kam, came ;	gekommen, come.
Laufen, run ;	lief, ran ;	gelaufen, run.
Schaffen, create ;	ſchuf, created ;	geſchaffen, created.

Besides the vowel-changes indicated above, verbs of the ancient conjugation have the following characteristics :—

(*a*) The past participle ends in -en or -n, and is thereby distinguished from that of the New Form ending in -et or -t ; thus :—

OLD FORM.	NEW FORM.
Geholfen, helped (from Helfen).	Gelobt, praised (from Loben).
Gefallen, fallen (from Fallen).	Geliebt, loved (from Lieben).
Getragen, borne (from Tragen).	Gelabt, quickened (from Laben).
Geboten, bidden (from Bieten).	Getauſcht, exchanged (from Tauſchen).

(*b*) Those having a in the *first* person singular of the present indicative, and in the participle, assume the Umlaut in the *second* and the *third* person singular ; thus :—

INDICATIVE.—*Present.*

Sing.	*Plur.*	*Sing.*	*Plur.*
Ich fange	Wir fangen.	Ich ſchlage	Wir ſchlagen.
Du fängſt	Ihr fangt.	Du ſchlägſt	Ihr ſchlagt.
Er fängt	Sie fangen.	Er ſchlägt	Sie ſchlagen.

(*c*) Some verbs having e (long) in the *first* person singular of the present indicative, take in the *second* and the *third* person ie ; and some having e (short) take in the same places the vowel i (short) ; and in both instances the imperative (*second person singular*) adopts the vowel-form of the second person of the indicative. Thus :—

INDICATIVE.—*Present.*

Sing.	*Plur.*	*Sing.*	*Plur.*
Ich leſe, I read.	Wir leſen.	Ich helfe, I help.	Wir helfen.
Du lieſeſt	Ihr leſt.	Du hilfſt	Ihr helft.
Er lieſt	Sie leſen.	Er hilft	Sie helfen.

IMPERATIVE.—*Present.*

Singular.

Lies du (for lieſe), read thou.	Hilf tu (for hilfe), help thou.
Leſe er, let him read.	Helfe er, let him help.

Plural.

Leſen wir, let us read.	Helfen wir, let us help.
Leſet ihr, read ye *or* you.	Helfet ihr, help ye *or* you.
Leſen ſie, let them read.	Helfen ſie, let them help.

The verbs that thus adopt the vowel-form of the second person of the indicative lose also the characteristic -e final ; giving, as above, lies, for lieſe ; hilf, for hilfe, etc. The unaccented e final is, in other instances, also sometimes omitted.

(*d*) In the past subjunctive the radical vowel, if it be capable of it, assumes the Umlaut ; thus :—

INDICATIVE.—*Past.*		SUBJUNCTIVE.—*Past.*	
Sing.	*Plur.*	*Sing.*	*Plur.*
Ich ſprach	Wir ſprachen.	Ich ſpräche	Wir ſprächen.
Du ſprachſt	Ihr ſpracht.	Du ſprächeſt	Ihr ſprächet.
Er ſprach	Sie ſprachen.	Er ſpräche	Sie ſprächen.
Ich ſchlug	Wir ſchlugen.	Ich ſchlüge	Wir ſchlügen.
Du ſchlugſt	Ihr ſchlugt.	Du ſchlügeſt	Ihr ſchlüget.
Er ſchlug	Sie ſchlugen.	Er ſchlüge	Sie ſchlügen.

TRANSLATION FROM GERMAN.

Die Canarienvögelchen

Ein kleines Mädchen, Namens Carolina, hatte ein allerliebſtes Canarienvögelchen. Das Thierchen ſang vom frühen Morgen bis an den Abend, und war ſehr ſchön goldgelb mit ſchwarzem Häubchen. Carolina aber gab ihm zu eſſen Saamen und kühlendes Kraut, auch zuweilen ein Stücken Zucker und täglich friſches Waſſer.

Aber plötzlich begann das Vögelchen zu trauern, und eines Morgens, als Carolina ihm Waſſer bringen wollte, lag es todt im Käfig.

Da erhob die Kleine ein lautes Wehklagen um das geliebte Thier und weinte ſehr. Die Mutter des Mädchens aber ging hin und kaufte ein anderes, das noch ſchöner war an Farben und eben ſo lieblich ſang wie jenes, und that es in dem Käfig.

Allein das Mägdlein weinete noch lauter, als es das neue Vögelchen ſah. Da wunderte ſich die Mutter ſehr und ſprach: „Mein liebes Kind, warum weineſt du noch, und biſt ſo ſehr betrübt? Deine Thränen werden das geſtorbene Vogelchen nicht in das Leben rufen, und hier haſt du ja ein andres, das nicht ſchlechter iſt denn jenes." Da ſprach das Kind: „Ach, liebe Mutter, ich habe Unrecht gegen das Thierchen gehandelt, und nicht alles an ihm gethan, was ich ſollte und konnte."

„Liebe Lina," antwortete die Mutter, „du haſt ſein ja ſorgfältig gepflegt." „Ach, nein," erwiederte das Kind, „ich habe noch kurz vor ſeinem Tode ein Stückchen Zucker, das du mir für daſſelbe gabſt, ihm nicht gebracht, ſondern ſelbſt gegeſſen." So ſprach das Mädchen, mit betrubtem Herzen. Die Mutter aber lächelte nicht uber die Klagen des Mädchens, denn ſie erkannte wohl und verehrte die heilige Stimme der Natur in dem Herzen des Kindes. „Ach!" ſagte ſie, „wie mag dem undankbaren Kinde zu Muthe ſein am Grabe der Eltern.'

COMPARATIVE ANATOMY.—III.

[*Continued from p.* 253.]

CŒLENTERATA-HYDROZOA (*continued*).

OTHERWISE well-educated men, who know nothing of the natural sciences (and the number of these is large), often declare that the lowest animal is but little removed from the highest plant. This, however, is a popular error, and the reverse of this is the case. The true statement is that both kingdoms start from the same point. The simplest and lowest forms of both, especially in their immature condition, are almost identical. At this simplest and earliest stage of development, the plant makes quite as decided an approach towards the typical life of an animal as does the animal make a counter-approach towards the typical life of a vegetable. The young spore of a conferva (vegetable) is locomotive, and moves by the same mechanism as some protozoa. Thus the animal and vegetable kingdoms not only meet at their lowest point, but the vegetable, so to speak, travels more than half way to effect the meeting. From this common point of contact the two kingdoms slowly diverge from one another; but the divergence is so gradual, the angle of divergence is so small, that for some distance they move in an almost parallel course. Now, as the vegetable stops far short of the development of the animal kingdom, we must look for the parallel to its higher forms, not in the lowest animals of all, but in those at some little distance up the scale; not in the last and lowest division, *Protozoa*, but in the *Cœlenterata.* It must, however, be remembered that the analogy to plants is only a parallel. There are no intermediate forms connecting the most plant-like hydrozoon with the most coral-like plant. To find the links of the chain of life which connects them, we must run downward through all the grades of animal life, to mount up again by the different grades of vegetable development. We shall find that though there are fundamental differences, yet the analogy is very strict between Cœlenterata and plants in very many respects.

Though unlimited growth and repetition of parts be the main characteristic of both Cœlenterata and the higher plants, some of the former are simple enough. Just as the little pasch-flower (*Anemone pulsatilla*) sends up its one blossom in the grass, so does the little fresh-water hydra extend its few tentacles around the mouth end of its tubular body, while it attaches itself, by the other end of the tube, to a water weed.

This animal is simply a tube or bag, while its tentacles are narrower tubes, whose hollows communicate with the main one. These are arranged in a circle round the mouth, which is a perforation in the free end of the tube. The bag is flexible, and composed of two layers of tissue closely adhering to one another. The long arms sway about in search of food. Any little animal unfortunate enough to come in contact with them, becomes benumbed by some stinging organs they contain. They then close around the prey, and press it in through the mouth into the interior, where its soft parts are dissolved, and its insoluble part is passed out again by the way it entered.

This short description leads us to remark upon the character which cuts off the Cœlenterata from the higher animals. In the case mentioned, it will be noticed that the animal is, so to speak, all stomach. The bounding wall of the stomach is also the wall of the body. In the higher animals the food cavity is distinct from the body cavity. These higher animals consist of a tube within a tube. The nutriment derived from food by them is strained through the walls of the inner tube, or otherwise abstracted from it, before it can be applied to the maintenance of the tissues of their bodies. In all the Cœlenterata, the food tube is not shut off from the cavity of the body. In the *Hydra*, the stomach is identical with the body cavity; in others, the stomach is continuous with the body cavity, being only partially cut off from it by a circular valve, so that the stomach acts as a kind of porch or vestibule to detain the food a short time, and it is then passed on into the lower part of a tube of equal dimensions. In others the central stomach divides into radiating hollows, and these divide and subdivide, and often produce a network of fine canals. In these the stomach presents the structure, and has also the office of both stomach and blood system of higher animals. All the animals which have stomachs such as we have described belong to the sub-division of the Cœlenterata called *Hydrozoa*. The other sub-division, called *Anthozoa*, presents a different arrangement. With them, although the stomach freely communicates with the body cavity, it is not identical with it, and cannot be said to be continuous with it. Indeed, these animals show an approach to a higher grade by having a stomach within the body wall; but this tube within a tube is not perfect, but opens below into the general cavity of the body. Also a number of partitions run from the body wall to the stomach, so as to maintain the latter in its position, and to divide the body cavity into compartments. This arrangement is seen in Fig. 17.

To return to the Hydrozoa. The simple hydra is a locomotive tube, but it fixes itself by one end in a temporary manner. This animal produces young not only from eggs in the ordinary way, but also by putting forth buds from its sides, which, while attached to the parent, develop mouths and arms, and then become separated, being able to live for themselves.

The hydra, therefore, exhibits functions and tendencies which, when carried to a greater extent in other species, produce very many modifications, and these may be grouped under two types which, though apparently very different, are, as we shall see, closely connected with one another.

1st, the fixed and branched hydrozoa, with long branching stem, each of whose heads is very like the hydra; and 2nd, the free swimming hydrozoa, which float at large in the ocean, and have locomotive organs to raise them to the surface and propel them along.

The animals which range themselves round the first of these types are the most perfect examples of the vegetative habit. The home of the Cœlenterata is the water, and almost all except the hydra live exclusively in the salt waters of the ocean. These *fixed* hydrozoa, of course, need not only an atmosphere of water, but a bottom whereon to grow. They are to be found around our coasts, some of them in the pools left by the retreating tide between high and low-water mark. The dredge has brought up some of these animals from great depths. Most of these plant-like compound animals are invested with a horny sheath which covers the stem and branches, so that the beautiful patterns in which they grow may be preserved after the soft parts of the animal have dried up. A collection of such dried specimens gives a far better idea of the animals than a dry herbarium gives of the different species of plants; for the hard parts being of a stiffer nature, and external instead of internal, the outer form is far better preserved.

The animals represented by the other type are far more independent. They need no sea-bottom, and are not confined to the coast, but swim freely in the sea far from any land. The naturalist who during a sea-voyage has energy enough to construct a surface-net and trail it from the vessel's stern in fine calm weather, is sure to be rewarded by obtaining many of these animals. They, however, of course, collapse when removed from their element, and have to be re-immersed in a pail of water before they exhibit their beautiful structure. We have said these animals swim in mid-ocean; but how do they swim? They swim by means of two different kinds of organs, one active and the other passive. One order is possessed of a float or bladder which holds air, so that by means of this they can be kept near the surface while attached to their float, and hanging down from it either directly or by the intervention of a long living rope, the polypites extend themselves in order to be ready to devour any small prey with which they or their tentacles come in contact, as the whole system is drifted by wind and current along the surface. Other free-swimming hydrozoa have, in addition to or in lieu of floats, flexible and contractile cups, to the outside of which the strings of polypites are slung. These cups the animal causes to be suddenly contracted by bringing the sides of the cup forcibly together, and so driving out the water. This motion causes the cup to be driven in the direction towards which the bottom of the cup is turned, and so to drag after it the chain of polypites. The cup is then allowed slowly to dilate by the elasticity of its substance, and is then again forcibly contracted. It may be conjectured that these swimming organs, though they have a locomotive function, are not used to effect locomotion in any definite direction, except it be upward or downward. No doubt, the instinct of these creatures, low as it is, induces them to seek the surface in fine calm weather, and to sink to stiller depths when rain and storms come. Trailing as a car from its balloon, these creatures are floated through the ocean and find their food haphazard. The question arises, how do such soft and feeble creatures secure live things which have much greater power of locomotion than themselves, and whose struggles, one would think, would be sufficient to tear the delicate arms of their captors quite away? Their power of capture is rather chemical than mechanical. All the Cœlenterata have small organs embedded in their tissues near the surface, called thread-cells. They are especially numerous in the tentacles, and consist of small double-walled sacs. Under the slightest excitement or touch, a long fine thread, which lay coiled up, is darted forth with a rapid motion. This thread is a stinging organ. Not only are the little animals which come in contact with the arms of the hydrozoa seen to become benumbed and helpless, but even upon man the stinging is sometimes severe. One of the largest of the float-bearing hydrozoa, which is a very conspicuous object at sea, not only from its comparatively large size, but also from the beauty of the rainbow tints which shine forth from its float, is called the Portuguese man-of-war. This animal furnishes the rough-and-ready seaman with a means of gratifying his taste for practical jokes. The Portuguese man-of-war is put in a pail, and the novice is induced to touch it, when he not only becomes the victim of the discharge from the man-of-war, but also of a broadside of laughter from the crew of his own vessel. Aristotle was so well acquainted with the stinging power of these animals, that he called them Acalephæ (or nettles).

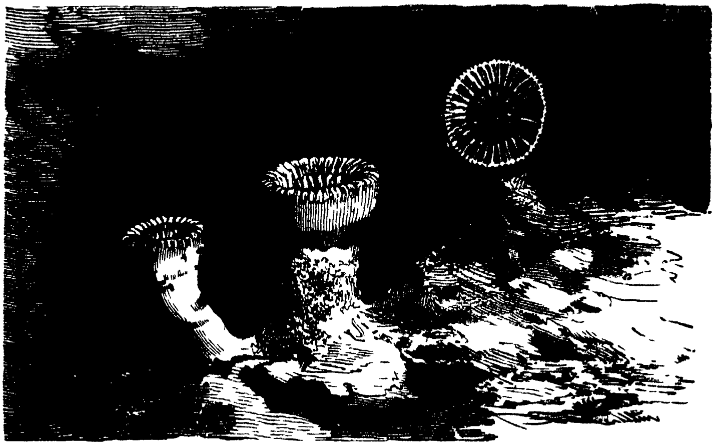

Fig 18.—CORAL (*Caryophyllia cyathus*).

There are other free-swimming hydrozoa, which differ from those described in that their swimming cup is single, and instead of having the living rope with its polypites and tentacles slung on to its outside, has a single polypite suspended from the centre of its under or concave side, while the tentacles are arranged at regular intervals round the margin of the cup. The mouth of the polypite leads into a central stomach, which sends out unbranched radial canals to run to the margin, where they are connected with a circular canal, which runs round the lip of the cup; or the canals divide repeatedly and there is no circular canal. These kinds are both called Medusæ, from Medusa, whom Neptune loved for her golden locks, which were afterwards converted into headed snakes. But they differ remarkably in their history; many of the former are budded off from hydriform colonies, and give rise to young which grow up into hydræ; the latter are never hydriform colonies at any time of their life history.

The Hydrozoa may be divided into three orders, and thus defined —

1. *Hydromedusæ.*—Hydrozoa characterised by a single locomotive polypite; or compound, fixed, provided with free medusæ or with medusiform buds, whence fresh forms arise; or fixed, without medusæ.

2. *Siphonophora.*—Free-swimming animals, with an undivided string of polypites slung to the outside of one or more swimming cups, and sometimes having floats.

3. *Discophora.*—Animals formed of a single polypite and having a large disc.

These are well marked characters by which to distinguish the order.

ANTHOZOA (FLOWER-LIKE ANIMALS).

It is perhaps well to make some remarks here with regard to the places where and the conditions under which these animals live. Technically, the place and conditions are called the habitat and station of a species. All the Cœlenterata, as we have observed, are inhabitants of the water, and all the Anthozoa are confined to the sea. Until we become acquainted with the lower and the lowest animals, we are apt to conclude that the conditions under which we live are those most favourable to life. Admirably adapted as the human body is to perform all the functions of life, man treads the solid earth and breathes the fluid air, furnished with senses and powers which enable him to escape the manifold dangers and to provide against the constant changes of aërial life, and he does this with such ease that he forgets entirely that he is living under difficult conditions, over which it is only his superior organism that gives him the mastery. Whenever the most experienced swimmer or diver takes a "header" into the sea, he leaves behind him the better part of all his perceptive and locomotive powers. The eyes and ears seem muffled, and locomotion becomes a struggle in which he is conscious of wasted power, producing insignificant results. Helpless when thrown upon the ocean, he succumbs at once when plunged beneath its surface. Hence it is not at all unlikely that he should consider the air as the vital fluid and the water the abode of death. The landsman thinks of the continent as abounding with life, and rich with the forms of beauty to which life gives origin, but he thinks of the ocean as a waste, desolate and void. Of course the slightest reflection and knowledge would remove this extreme idea. Our fisheries, maintaining their ground as sources of wealth and means of employment, when the chase of all land animals has ceased to be remunerative, proclaim to the economist, though he be no naturalist, that the water, rather than the land, gives shelter to living things. Nevertheless, few people sufficiently recognise that the converse of the common notion is correct. Life is far more easily maintained in water than in air. Structures which could not support their own weight in air may be locomotive organs in water, urging the body to which they are attached—slowly, it is true, but effectively—through a medium which, though of greater resistance, presses equally on all parts. Delicate and feeble organs, which would collapse in air, are floated forth in water to subserve the touching, or even the seizing function. Moisture, which is so necessary to almost all the organs, and to the performance of almost all functions, has not to be retained and husbanded with care and contrivance, but laves the whole body.

As a striking instance of the importance of this last consideration, it may be stated that the respiration of any animal can only be maintained by having a moist membrane with the fluids of the body on one (internal) side, and oxygen on the outer side. These are the necessary conditions of respiration, and therefore of life. Now the water contains a sufficient amount of oxygen for the purposes of respiration dissolved in it, and the other condition—namely, the moisture of the membrane which contains the nutritive fluid of the body—is maintained in the water-animal without any contrivance whatever. Hence the exterior of the body, or a lobe or leaflet protruded into the water around, is quite sufficient to enable water-animals to breathe. On land it is different. The higher animals must have elaborate contrivances to maintain the moisture of the respiratory membrane. It must be placed internally, lest the external air and wind should carry off the moisture. It must be confined to small cavities, lest their large capacity should incommode the animals, and, being thus limited, the membrane must be folded elaborately to increase its area. In animals where these contrivances are not found, or not found in efficient condition, life in the air is difficult to maintain. Such animals are always in danger of being dried up. Thus, the toad must keep to his dark, moist hole. The grey slug never comes out but at night, and the black slug only after rain. It is, in fact, scarcely too much to say that the water is both the home and the cradle of life. Not only are all the lower animals aquatic, but the lower forms of many of the higher classes are so too. Both zoology and geology proclaim this fact. Life teems in the ocean.

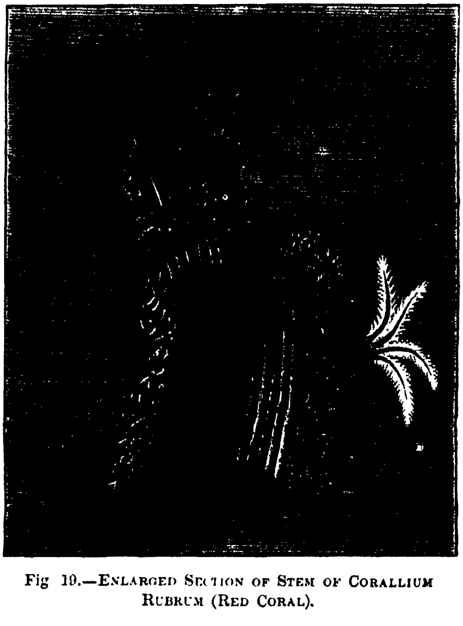

Fig 10.—Enlarged Section of Stem of Corallium Rubrum (Red Coral).

Its countless myriads of forms people the main and crowd up even to the coast-line, despite the dangers of the beach. Every sweep of the entomologist's water-net in a fresh-water stream takes some living thing, and every drop of water contains countless animals. Though Nature is redundant of forms everywhere, yet this could scarcely be said of earth or air. With extreme difficulty do animated forms seem to have made conquest of the earth and air. Their mother country, their arsenal where they prepared and armed themselves for the expedition, was the water. Insects. more than any other living things, are at home in the air, but many of them pass their earlier stages, when they are feeble and need protection and easy conditions of life, in the water. The crust of the earth contains multitudes of animal remains, but the aquatic forms outnumber the aërial in an almost unlimited proportion. Further, the first forms found in the earliest strata are water-animals, and we have good reason to believe that fish existed before reptiles, birds, or beasts.

In conformity with the preceding remarks, we find and have found that, in tracing upward the grades of the animal kingdom, we have not yet arrived at any animals suited for an aërial existence. Their parts are not sufficiently differentiated for such a life. With regard to many of the Cœlenterata, if placed where the water drains away from them they fall to pieces, or sink into a semi-fluid slimy condition, never to be restored to their original form.

The type of the class Anthozoa, which occupies the same relation to the rest of these animals that the simple hydra does to the Hydrozoa, is the common sea anemone (*Actinia mesembryanthemum*). This animal has already been described, and its structure may be understood by looking at the diagram of its vertical section given in the illustration on page 252 (Fig. 15), and the description there given.

The common sea-anemone is wholly soft, but some of its near allies exhibit a tendency whose results are very complicated and interesting. This tendency is to deposit either externally, or in the substance of their tissues, carbonate of lime, which, being of the same nature as marble, is hard and enduring. This encrustation forms both a protection and a support to the otherwise soft animals, so that they can not only endure but enjoy the buffeting of the great surface billows of the ocean. Anthozoa of this kind are not so common in England as in the tropical seas, but a few are to be found on our coasts. When this tendency to deposit a hard structure of carbonate of lime is associated with a tendency to grow, and branch, and bud, which we have remarked in the Hydrozoa, the two united tendencies produce those most beautiful forms we call corals (Fig. 19). Very various are the forms assumed by corals. One is called ***Fungia Agariciformis***, or the mushroom-like coral, on account of its resemblance to that fungus. The likeness, however, is rather to what the mushroom would be if deprived of its stalk and the upper part of its dome, than what it really is. Another is called the brain coral, from the very much closer resemblance which it bears to the brain of a man, being grooved into sinuous channels just like those channels which are called the convolutions of the brain. Other forms are branched like a stag's horn, or spread out like a fan. A thousand different modifications are found, but each is made up of almost the same elements. Each element is almost identical with the hard part of the little English coral represented in the engraving (Fig. 18) as stripped of its soft parts. Each consists of an outer cup with plates developed from its walls, and stretching inwards as they grow towards a central part, where, when the soft parts existed, the stomach was situated, lying immediately under the central mouth. The great differences are the results of the manner in which budding takes place from the original parent element: as, for instance, whether the buds spring from the side wall, or from the disc between the mouth and tentacles; whether a great many are formed at the same time, or only two, or one, at once; whether they sprout out at a small or large angle, etc. etc.

SPANISH.—I.

ORTHOGRAPHY AND PRONUNCIATION.

THE SPANISH ALPHABET.

THE Spanish Alphabet contains twenty-eight characters or letters: *a*, *b*, *c*, *ch*, *d*, *e*, *f*, *g*, *h*, *i*, *j*, *k*, *l*, *ll*, *m*, *n*, *ñ*, *o*, *p*, *q*, *r*, *s*, *t*, *u*, *v*, *x*, *y*, *z*.

Of these letters, *a*, *e*, *i*, *o*, *u* are always vowels; *y* is also a vowel when it begins or ends a syllable or word, or when it stands alone: the other letters are consonants. The consonants are divided into semi-vowels and mutes: the semi-vowels being *f*, *h*, *l*, *ll*, *m*, *n*, *ñ*, *r*, *s*, *x*; and the mutes, *b*, *c*, *ch*, *d*, *g*, *j*, *k*, *p*, *q*, *t*, *v*, *z*.

SOUND OF THE SIMPLE VOWELS.

A, in Spanish, has invariably the sound of ***a*** in the English word *far*.

E has the sound of *a* in *made*, or *e* in *they*.

I has the sound of *ee* in *see*, or *i* in *machine*. Y, when a vowel, has the same sound.

O has the sound of *o* in *go*.

U has the sound of *oo* in *mood*, or *u* in ***rude***.

SOUND OF THE CONSONANTS.

B, F, K, L, M, N, P sound as in English.

C before *a*, *o*, or *u*, or before a consonant, sounds like *c* in the English word *cart:* as, *carne*, *poco*, *cuna*, *creo;* pronounced *kar'-ney*, *pó-ko*, *koó-nah*, *kray'-o*.

C before *e* or *i* sounds like *th* in the English word *think:* as, *cecina*, *cima;* pronounced *thay-thcé-nah*, *theé-mah*.

CH is considered as one letter in Spanish, and is always sounded like *ch* in the English word *church:* as, *noche*, *chapa;* pronounced *nó-chay*, *chah'-pah*.

D sounds as in English, except at the end of words; then it has a sound nearly like *th* in the English word *hath:* as Madrid; pronounced *Mad-reeth*.

G before *a*, *o*, *u*, or a consonant, sounds hard, as in the English words *gate*, *go:* as, *goce*, *greba*, *gula;* pronounced *go-thay*, *gray'-bah*, *goo'-lah*.

GU, in the syllables *gue* and *gui*, unless there be a diæresis—called *crema* (¨)—over the *u*, is always sounded like the simple *g* hard, as in the English words *guest*, *guilt:* as, *gueta*, *guita;* pronounced *gay'-tah*, *geé-tah*. When the diæresis is over the *u* it is not mute, but has its proper sound: as, *agüelo;* pronounced *ah-goo-ail'-o*, or *ah-gway'-lo*.

G before *e* or *i* has in all cases the guttural sound of the Spanish *j*.

H is always a silent letter: as, *hace*, *higo;* pronounced *ah'-thay*, *eé-go*.

J has always a guttural sound, somewhat like the English *h* in *alcohol*, strongly aspirated. It is the guttural sound of the *ch* in the German words *nacht* and *nicht*, and of the *ch* in the Scotch words *loch*, *clock*, and can therefore be learnt from any German or Scotchman. The learner must bear in mind that the sound of the Spanish *g* before *e* or *i* is the same guttural sound.

K is not used in Spanish, being found only in foreign words, when it is sounded like the same letter in English.

LL sounds like *li* in *pavilion*, or *lli* in *million:* as, *silla*, *lloro;* pronounced *seel'-yah*, *lyó-ro*.

Ñ sounds like *ni* in the English words *onion*, *pinion:* as, *noña*, *ñoño;* pronounced *non'-yah*, *nyon'-yo*.

Q, which is always immediately followed by *u*, is sounded as in English: as, *quota;* pronounced *kwo'-tah*.

QU, in the syllables *que* and *qui*, is sounded like *k* (that is, the *u* silent): as, *que*, *quiso;* pronounced *kay*, *keé-so*. But if a diæresis is over the *u*, it has its proper Spanish sound: as, *qüesta;* pronounced *koo-ais'-tah* or *kwais'-tah*.

R is sometimes sounded smooth, and sometimes rough or trilling. The rough sound is heard in Spanish when *r* begins a word, when doubled, and when it comes after *l*, *n*, or *s:* as, *rabo*, *carro*, *alrota;* pronounced *r-rah'-bo*, *kar-r'-ro*, *al-r-ro'-tah*. In every other position it has the smooth sound.

S is always sounded as in the English words *soon*, *this:* as, *sedes;* pronounced *say'-dace*.

T has nearly the same sound as in English. The only difference is, that in Spanish *t* has a somewhat softer sound than in English.

V is pronounced as in English, with the sole exception that the upper teeth are not pressed so strongly to the lower lip in pronouncing this letter in Spanish.

X has the sound of the English *x* in the word *tax:* as, *exito*, *extremo*, *exacto;* pronounced *aiks-eé-to*, *aiks-tray'-mo*, *aiks-ak'-to*.

X, in Spanish, had formerly two very different sounds: the one the same as above given; the other a guttural sound, the same exactly as the Spanish *j*. To distinguish these sounds, the vowel following the *x*, when not guttural, had a circumflex accent over it, as, *exâcto*, *exîto*. The guttural sound of *x* is not at present used, or at least very seldom, in Spanish, as the letters *j* (before any vowel) and *g* (before *e* and *i*) have the same sound, and are now employed instead of the guttural *x*. Thus the words *México*, *Méjico*, or *Mégico* would, in Spanish, all be pronounced alike; though *Méjico* is the common spelling. It is, of course, no longer necessary to put a circumflex accent over the vowel following the *x* when the letter has the English sound of *ks*, as it now has nearly always in recent Spanish writings.

Y, when a consonant, has the same sound in Spanish that it has in English in such words as *young*, *year*.

Y, when it stands alone, used as a copulative (meaning *and*), is pronounced like *ee* in *see*.

Z has always the sound of *th* in the English word *think:* as, *zuzo;* pronounced *thoo-tho*.

Remark.—There will be no difficulty on the part of the learner, who is his own instructor, in acquiring the sounds of the Spanish vowels and consonants, except the guttural sound of the *j* (which is also the sound of *g* before *e* or *i*); and this sound can be learnt from any German, by hearing him pronounce *ch* in the words *nacht* and *nicht;* from an Irishman, by noticing the sound he gives *ch* in the word *oich;* from a Scotchman in the word *loch;* or from a Welshman in the words *bach*, *chwi*.

DIFFERENT METHODS OF SPELLING.

By the best Spanish writers *i* is used instead of *y* when this last letter is a vowel, and not at the end of a word. Thus *reyno*, *reyna*, *arraygar* are now spelt *reino*, *reina*, *arraigar*.

Q is now used by the best writers only in the syllables *que* and *qui:* as, *queja*, *quince*. The syllables *qua*, *qüe*, *qüi*, and *quo* are spelt with *c*. Thus *quando*, *qüesto*, *quota* are now spelt *cuando*, *cuesto*, *cuota*.

X is, by many of the best writers, never used before a consonant, its place being supplied by the letter *s*. Thus *extenso*, *experto* are now often found spelt *estenso*, *esperto*.

In addition to the above remarks, it is proper to state that, by the best writers, *z* is never employed before *e* or *i*, its place being supplied with *c;* thus *cero* and *cinco*, for *zero* and *zinco*. X, too, is, by some writers, always changed into *cs* when it comes before a vowel; thus *secso*, for *sexo*. The guttural sound of *x*, as has been already mentioned, is now seldom used; *g* or *j* being substituted for it.

Remark.—It is necessary to remember that the above variations in spelling produce no variations in pronunciation, except only when *x* before a consonant is changed into *s*, in which case *s* has its own regular sound; thus *estenso* is pronounced *ais-ten'-so*.

A very little attention to the above directions will remove every difficulty which might otherwise occur in reading Spanish authors who do not adopt the same method of spelling. Thus, if the learner meet with such words as *celo*, *jéneros*, *rejistro*, *cuando*, *jabon*, *esceso*, *ecsactor*, *reina*, *buitre*, etc., and cannot find them in his dictionary, he must look for them under the other forms: *zelo*, *géneros*, *registro*, *quando*, *xabon*, *exceso*, *exactor*, *reyna*, *buytre*.

SOUND OF THE DIPHTHONGS AND TRIPHTHONGS.

The diphthongs and triphthongs in Spanish never contain any vowel sound different from those we have already given. When two or three vowels come together, they may be pronounced by a single emission of the voice; but each vowel in Spanish continues to retain always its own particular sound, though the sounds glide into each other by being pronounced in the time of a single vowel. Two vowels are never mingled into one and made to represent a sound foreign to each of them, as *ou* in the English word *fought;* or a sound in which only one is heard, as *oa* in *boat*. The diphthong *ua*, in the English word *suarity*, retains the sounds of both vowels, being pronounced as if written *sooa-ri-ty*. The learner can judge from this example what is meant by each vowel retaining its own particular sound in diphthongs and triphthongs, though such a combination forms, of course, but one syllable. Thus, in the Spanish word *causa*, the letters *cau* compose but one syllable, and the diphthong *au* is pronounced like *a* in *bar* and *u* in *rude* (the regular Spanish sounds of *a* and *u*); and being uttered quickly, and by a single impulse of the voice, the sound of *au* is similar to that of *ow* in the English *how*, though not exactly the same.

LIST OF DIPHTHONGS.

ai or *ay*,	has the sound of	*a* in *bar*,	and *ee* in *eel:*	*a-i.*
au	,, ,,	*a* in *bar*,	and *oo* in *mood:*	*a-u.*
ea	,, ,,	*e* in *they*,	and *a* in *bar:*	*e-a.*
ei or *ey*,	,, ,,	*e* in *they*,	and *ee* in *eel:*	*e-i.*
eo	,, ,,	*e* in *they*,	and *o* in *go:*	*e-o.*
eu	,, ,,	*e* in *they*,	and *oo* in *mood:*	*e-u.*
ia	,, ,,	*e* in *he*,	and *a* in *bar:*	*i-a.*
ie	,, ,,	*e* in *he*,	and *e* in *they:*	*i-e.*
io	,, ,,	*e* in *he*,	and *o* in *go:*	*i-o.*
iu	,, ,,	*e* in *he*,	and *oo* in *mood:*	*i-u.*
oe	,, ,,	*o* in *go*,	and *e* in *they:*	*o-e.*
oi, or *oy*	,, ,,	*o* in *go*,	and *ee* in *eel:*	*o-i.*
ua	,, ,,	*oo* in *mood*,	and *a* in *bar:*	*u-a.*
ue	,, ,,	*oo* in *mood*,	and *e* in *they:*	*u-e.*
ui, or *uy*	,, ,,	*oo* in *mood*,	and *ee* in *eel:*	*u-i.*
uo	,, ,,	*oo* in *mood*,	and *o* in *go:*	*u-o.*

TRIPHTHONGS.

iai	has the sound of	*ee* in *eel*,	*a* in *bar*,	and *e* in *he:*	*i-a-i.*
iei	,, ,,	*ee* in *eel*,	*e* in *they*,	and *e* in *he:*	*i-e-i.*
uai	,, ,,	*oo* in *mood*,	*a* in *bar*,	and *e* in *he:*	*u-a-i.*
uei, or *uey*	,,	*oo* in *mood*,	*e* in *they*,	and *e* in *he:*	*u-e-i.*

Remark.—Some of the diphthongs ending in *i* will be found in some Spanish writings ending in *y:* as *reina*, *reyna;* *buitre*, *buytre*. The pronunciation in both cases is the same.

The two vowels, when they come together, do not always form one syllable (a diphthong). Thus the word *idéa*, in Spanish and English, forms three syllables.

SYLLABICATION.

When a consonant comes between two vowels, it is articulated with the vowel which comes after it; as, *fó-so*, *á-ño*, *hu-má-no:* except *x;* as, *ex-ém-plo*.

When two consonants come between two vowels, the former is spelt with the preceding vowel, and the latter with the succeeding vowel; as, *por-tál*, *cuér-po*, *és-te*, *in-viér-no*. This rule is subject to the following exception.—

If the first of two consonants coming between two vowels be *f*, or any of the mutes, and the second *l* or *r*, then both consonants are joined to the vowel by which they are succeeded: as, *sí-glo*, *sué-gro*, *co-bre*, *vi-drié-ro;* with the exceptions of *at-leta*, *at-lante*.

When two vowels of the same name come together, or two which do not form a diphthong, they are to be divided; as. *le-ér*, *co-or-di-nár*, *ca-nó-a*.

Compound words are to be divided into their derivatives; as *pre-po-nér*, *ad-jún-to*, *con-flíc-to*.

When any one of the letters *b*, *l*, *m*, *n*, or *r* is followed by *s* and another consonant, or when *s* is preceded by any consonant, and succeeded by one or more, in compound words, the *s* is to be connected with the consonant which comes before it; as, *Cons-tán-za*, *cons-tre-nír*, *ins-pi-rár*.

In Spanish there are as many syllables in a word as there are vowels or diphthongs; as, *quin-ce*, *nor-te*, *pa-rien-te*.

In English, the word *quince* forms only one syllable; in Spanish it is pronounced *keen'-thay*. Every letter in Spanish is pronounced except the *h*, and the *u* in the syllables *gue*, *gui*, and *que*, *qui*. There are no silent vowels or consonants, as in the English words *thumb*, *throne*, *psalm*.

ACCENT.

In Spanish the voice never rests itself on any other letter of a syllable than a vowel. In the case of diphthongs and triphthongs, when in accented syllables, the accent is generally placed on that vowel which we have marked in the list of diphthongs and triphthongs. Thus *tie-ne*, having the accent on the first syllable, has the stress of the voice on the *e* of the diphthong, though the accent is not written over the vowel.

In words ending in *cion*, the accent is on the *o*, and not on the *i* of the diphthong, as marked in the list; as, *re-su-rec-cion*.

Words that end in a consonant are accented on the last syllable, without any marked accent over it: as, *caliz*, cup; *capaz*, able; *virtud*, virtue. These are accented as if written *ca-líz*, *vir-túd*, etc. Exceptions:—*Mártes*, Tuesday; *Viérnes*, Friday; and proper names ending in *ez*, as *Perez*.

Words that end in a vowel are accented on the syllable next to the last, without any marked accent over it: as, *rastro*, track; *hoja*, leaf; *buitre*, vulture; accented as if written *rás-tro*, *búi-tre*, etc.

Words that end in two vowels, whether their vowels form a diphthong or two separate syllables, come under the above rule: as, *odio*, hatred; *opulencia*, opulence; *idea*, idea; accented as if written *o-dio*, *o-pu-lén-cia*, *i-dé-a*.

Words that end in a consonant, and are accented on any other syllable than the last, or that end in a vowel (or diphthong), and are accented on any other than the syllable next to the last, have the accent marked to show the exception from the general rules: as, *cárcel*, prison; *carácter*, character; accented on the syllable marked.

Words that end in two vowels, which are commonly known as diphthongs, usually have the accent marked if it falls on one of the vowels; as, *fantasía*, *poesía*, *señorío*, *minué*. Words which end with *y* have the accent on the last syllable, without being marked.

In compound words there are a few exceptions to the above general rules. In adverbs of quality or manner, ending in *-mente*, some follow the general rule, and others retain the accent on the first part of the word, on the same syllable on which it would be if *-mente* were not affixed: as, *su-cin-ta-ménte*, succinctly; *li-be-ral-mén-te*, liberally.

The plurals of words retain the accent on the same syllable (whether marked or not) as in the singular: as, *jardin*, *jardines*; *caliz*, *calices*. There are two exceptions, *carácter* and *régimen*; their plurals being accented *caractéres* and *regímenes*.

The above rules are applicable to all parts of speech except the persons of verbs; these are accented according to the following rules:—

The persons of verbs are accented on the syllable next to the last, without being marked: as, *hablo*, I speak; *beben*, they drink; *hiciera*, he would make. Infinitives, having no person, are not included in this rule, but are always accented on the last syllable.

In the case of persons of verbs, whenever the accent does not fall on the syllable next to the last, it is marked: as, *está*, he is; *hablaré*, I shall speak; *hablarán*, they will speak; *amé*, I loved. The only exception to this rule is the second person plural of the imperative mood, and words ending in *ay* or *oy*, which are always accented on the last syllable, without the accent in general being marked: as, *hablad*, speak ye; *haced*, make ye; *estoy*, I am. Some writers, however, place the accent on the last syllable, as *hablád*, *hacéd*.

The accent is by many writers marked on certain monosyllables to distinguish them from others of similar orthography and pronunciation, but of different meaning: as, *el*, the, and *él*, he; *se*, himself, and *sé*, I know, and *sé*, be thou; *si*, if, and *sí*, to himself. The letters *á*, to; *é*, and; *ó*, or; *ú*, or, are also generally used with a marked accent, though some writers omit it.

Throughout these lessons, every word which does not come under the three general rules of accentuation will have the accent marked over the vowel upon which the stress of voice is to be laid.

The learner will now be able to pronounce the names of the Spanish letters of the alphabet, giving to each letter its true Spanish sound, according to the preceding directions:—*a*, *be*, *ce*, *che*, *de*, *e*, *efe*, *ge*, *ache*, *i*, *jota*, *ka*, *ele*, *elle*, *eme*, *ene*, *eñe*, *o*, *pe*, *cu*, *erre*, *ese*, *te*, *u*, *ve*, *equis*, *igriega*, *zeta*.

PUNCTUATION.

The comma, semicolon, colon, period, etc., are the same, and are employed in the same manner, as those in English. The marks of interrogation and exclamation are placed in Spanish both before and after interrogative and ejaculatory phrases or sentences: as, *¿Este canapé no es nuevo?* Is not this sofa new? *¡Que ceguedad!* *¡Pobre España!* What blindness! Poor Spain!

The diæresis (··) is used over the *u* in the syllables *gue*, *gui*, *que*, and *qui* when the *u* is to be sounded, as *agüero*; and also over the last of two vowels which usually form a diphthong, to indicate that they are to be divided into two syllables: as, *heroïcidad*; pronounced *ai-ro-ee-thee-dáth.*

The tilde (˜) is used over the *n* when this letter has the sound of *ni* in *onion;* as, *daño.*

The acute accent (ʹ) is placed over vowels, not to alter their sound, but to indicate the syllable on which the stress of voice is laid in pronouncing certain words; as, *órden.*

The circumflex accent (ˆ) was formerly used over a vowel following *x* when the letter had not its guttural sound, as *sexô;* and over a vowel following *ch* when the latter was pronounced as *k*, as *chîlo.* But the alterations in orthography no longer require this mark.

THE ARTICLE.

The definite article, which in English is always *the*, is rendered in Spanish by different words, according to the gender and number of the nouns before which it is used.

Before a noun masculine of the singular number, *el* is used: as—

El hombre, *the man.*	El hijo, *the son.*
El rey, *the king.*	El plato, *the plate.*

Before a noun feminine of the singular number, *la* is used: as—

La muger, *the woman.*	La hija, *the daughter.*
La reina, *the queen.*	La cuchara, *the spoon.*

Before a noun masculine of the plural number, *los* is used: as—

Los reyes, *the kings.*	Los platos, *the plates.*

Before a noun feminine of the plural number, *las* is used: as—

Las reinas, *the queens.*	Las cucharas, the spoons

Before an adjective used as a noun of the singular number, *lo* is employed when it has the meaning of *that which is*: as—

Lo bueno, *the good*, or *that which is good.*	Lo justo, *that which is just.*
Lo pasado, *the past*, or *that which is past.*	Lo rojo, *the red*, or *that which is red.*

Lo has no plural. It is called the *neuter* article.

The Spanish indefinite article, corresponding to *a* or *an* in English, is *uno* (always contracted to *un*), before a noun masculine: as—

Un médico, *a physician.*	Un sombrero, *a hat.*

Before a noun feminine, *una* is used: as—

Una hermana, *a sister.*	Una silla, *a chair.*

When the plural form of *uno* and *una* is used, these words are indefinite pronouns: as, unos hombres, *some men*, or unas mugeres, *some women.*

The masculine articles *el* and *un* are always used before feminine singular nouns when they begin with *a* or *ha*, accented on the first syllable* (whether the accent is marked or not): as—

El ama, *the mistress.*	El hambre, *the hunger.*
Un arca, *a chest.*	El ágna, *the water.*

In the plural, such nouns take the regular feminine article: as—

Las arcas, *the chests.*	Las águas, *the waters.*

If an adjective intervene between the article and the feminine noun (even though the adjective begin with *a* or *ha* accented), the feminine article is always used: as—

La ancha arca, *the broad chest.*	Una buena ama, *a good mistress.*

When the preposition *á* (to) or *de* (of) comes immediately before the masculine article *el*, a contraction takes place, and both words are united. Thus, instead of *á el* and *de el* (*to the* and *of the*), *al* and *del* are used: as—

Al padre, *to the father.*	Del muchacho, *of the boy.*
Al ama, *to the mistress.*	Del hambre, *of the hunger.*

Before the other articles, *la, los, las, lo, un,* and *una*, the prepositions *á* and *de*, as well as the articles, remain unchanged: as—

Á la muger, *to the woman.*	De los hombres, *of the men.*
Á las hermanas, *to the sisters.*	De lo futuro, *of the future.*
Á un dia, *to a day.*	De una noche, *of a night.*

De el is sometimes used before the surnames of persons; as, De el César, *of the Cæsar.*

VOCABULARY.

Alma, *soul.*	Futuro, *future.*	Hijo, *son.*
Ama, *mistress, housekeeper.*	Francesa, *Frenchwoman.*	Hombre, *man.*
Americano, *American.*	Hambre, *hunger, famine.*	Juez, *judge.*
Criada, *female servant.*	Hermana, *sister.*	Marido, *husband,*
Criado, *male servant.*	Hermano, *brother.*	Médico, *physician.*
	Hija, *daughter.*	Muger, *woman, wife.*
		Pasado, *past.*

The plural of such words in the above vocabulary as end with a vowel, is formed by adding *s* to the singular: as, hombre, *man;* hombres, *men.*

EXERCISE 1.

Translate into English:—

1. El juez. 2. El médico. 3. La criada. 4. La hermana del Americano. 5. Un criado del juez. 6. Una hija del médico. 7. Lo futuro. 8. Al alma del ama. 9. El hambre del criado. 10. El hijo del hermano del médico. 11. El criado de la muger. 12. Al hermano del juez. 13. Á una hija del Americano. 14. Lo pasado. 15. Los hombres. 16. Las hermanas de la Francesa. 17. Á las hijas de la muger. 18. Los hermanos de las criadas.

EXERCISE 2.

Translate into Spanish:—

1. The man. 2. The woman. 3. The soul. 4. The daughters. 5. The brother of the physician. 6. The husband of the woman. 7. The sister of the judge. 8. The sons of the American. 9. To the brothers of the physician. 10. To the souls of the female servants. 11. The daughters of the Frenchwoman. 12. The male servants of the sons of

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* Before feminine nouns singular beginning with *a* or *ha*, not accented on the first syllable, this rule does not apply; and, of course, *la* or *una* is used.

the physician. 13. The husbands of the daughters of the judge. 14. The brothers of the female servants.

THE NOUN.

Nouns are divided into proper and common, as in English; and to them belong gender, number, person, and case.

GENDER.

In Spanish grammar, every noun is considered as either masculine or feminine, whether it really has any gender or not.

The following are the rules for distinguishing the gender:—

Nouns which are the names of males, as well as those which denote the ranks, offices, professions, or employments of males, are masculine: as, hombre, *man;* perro, *dog;* rey, *king;* pintor, *painter;* zapatero, *shoemaker.*

Nouns which are the names of females, as well as those which denote the ranks, offices, professions, or employments of females, are feminine: as, muger, *woman;* vaca, *cow;* reina, *queen;* costurera, *seamstress;* zapatera, *shoemaker's wife.*

And of those which are not comprehended in the above rules:—

Nouns which end in *-a*, *-d*, *-ion*, *-is*, and *-ez*, are feminine: as, marca, *mark;* locura, *folly;* soledad, *solitude;* religion, *religion;* hipótesis, *hypothesis;* timidez, *timidity.*

Nouns which do not end in *-a*, *-d*, *-ion*, *-is*, and *-ez*, are masculine: as, zapato, *shoe;* honor, *honour;* té, *tea;* jabon, *soap.*

Nouns used only in the plural are of the gender to which they would belong, from their termination, if they had a singular form. Thus, calzones, *breeches*, is masculine, and grevas, *greaves*, is feminine, because *calzon* and *greva* would be of these respective genders, from their termination. *Lláres*, *fásces*, and *fauces* are exceptions to this rule, they being feminine.

Remark.—There are some few masculine nouns having feminine endings; and some few feminine nouns which end otherwise than in *-a*, *-d*, *-ion*, *-is*, and *-ez*.

The gender of the noun can always be distinguished by the article used before it, except in the case of feminine nouns singular, beginning with *a* or *ha*, accented on the first syllable. These, however, are very few in number.

NUMBER.

The plural number is formed from the singular by adding *es* to all nouns ending with a consonant, with the letter *y*, or with any accented vowel: as—

Muger, *woman.*	Mugeres, *women.*
Rey, *king*	Reyes, *kings.*
Aleli, *gillyflower*	Alelies, *gillyflowers.*

Nouns ending with a vowel not accented, form their plural by adding *s* to the singular: as—

Villa, *town.*	Villas, *towns*
Amigo, *friend.*	Amigos, *friends.*

There are a few exceptions to the above general rules for the formation of the plural nouns; they are as follow:—

If the noun end with *z*, this letter is changed into *-ces* to form the plural: as—

Juez, *judge.*	Jueces, *judges.*

If the noun end with *e* accented, the plural is formed by adding *s:* as—

Puntapie, *kick.*	Puntapies, *kicks.*

If the noun end with *s* immediately preceded by a vowel *not accented*, no change takes place to form the plural: as—

Hipótesis, *hypothesis.*	Hipótesis, *hypotheses.*

The following nouns are irregular in the formation of the plural:—Sofá, *sofa;* papá, *pope, father;* mamá, *mamma;* duc, *duke;* their plurals being *sofás*, *papás*, *mamás*, *duces.*

CASE.

In Spanish, nouns have but two cases, the *nominative* and the *objective*—the former being the agent or subject of the verb; the latter the object of an action expressed by the verb, or of a relation expressed by a preposition.

There is no *possessive* case in Spanish; property or possession is expressed by the means of the preposition *de:* as—

El hijo de Juan, *the son of John;* i.e., *John's son.*

La casa de la muger, *the house of the woman;* i.e., *the woman's house*

El libro es de María, *the book is of Mary;* i.e., *the book is Mary's.*

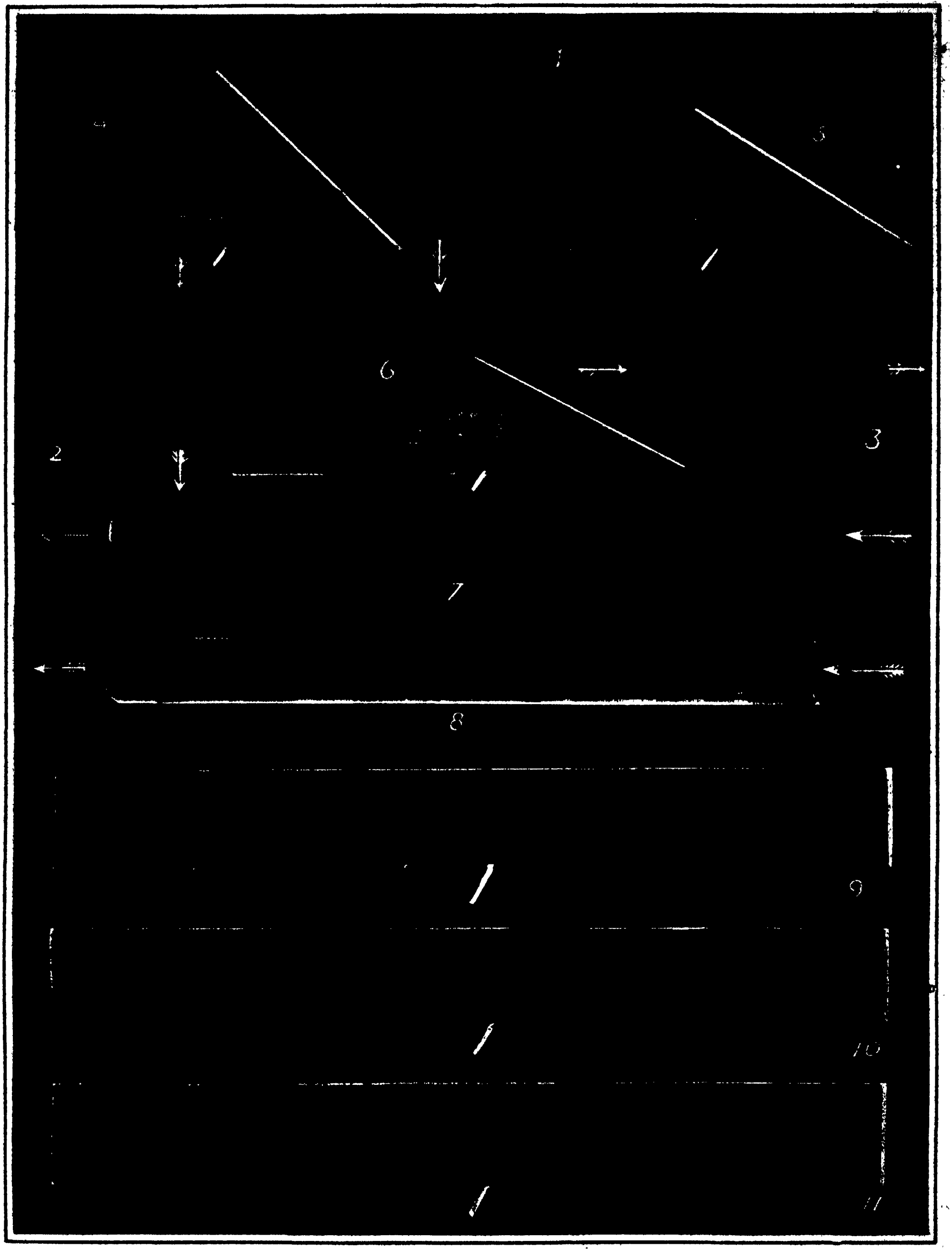
One noun cannot serve as an adjective for another noun, as in English. Thus, such phrases as—the York road, a paper hat, an ivory spoon, are in Spanish to be rendered: el camino de York, un sombrero de papel, una cuchara de marfil; i.e., *the road of* (*to* or *from*) *York*, *a hat of paper*, *a spoon of ivory.*

Remark.—It is necessary to mention that of the few verbs for the present given in the vocabulary, those ending with *n* are in the third person plural, and those not ending with *n* are in the third person singular.

The learner will be able to distinguish the gender of nouns, either from their sex or from their termination. Any noun forming an exception to the general rules of gender, will have its gender specified in the vocabulary, and should be remembered by the learner.

VOCABULARY.

Buey, *ox.*
Caballo, *horse.*
Carpintero, *carpenter.*
Carta, *letter.*
Casa, *house.*
Cuchara, *spoon.*
Dinero, *money.*
El pintor tiene, *the painter has.*
El pintor fue, *the painter went.*



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ELECTROLYTIC DEPOSITS.

(*See* ELECTRICITY LESSONS.)

El pintor dió, *the painter gave.*
El pintor escribió, *the painter wrote.*
Hambre, f., *hunger.*
Hoja, *leaf.*
Impresor, *printer.*
Libro, *book.*
Los pintores tienen, *the painters have.*
Los pinteros fueron, *the painters went.*
Los pintores dieron, *the painters gave.*
Los pintores escribieron, *the painters wrote.*
Madre, *mother.*
Navio, *ship.*
Oro, *gold.*
Padre, *father.*
Pintor, *painter.*
Plata, *silver.*
Sed, *thirst.*

The Spanish for *ship carpenter* is carpintero de navío, *carpenter of ship.*

It cannot be said in Spanish, I am hungry, I am thirsty, I am afraid, but I *have* hunger, I *have* thirst, I *have* fear.

EXERCISE 3.

Translate into English:—

1. Los impresores tienen dinero. 2. Las mugeres tienen hambre. 3. Los pintores tienen libros. 4. Los jueces tienen sed. 5. Las mugeres dieron libros al padre de la Francesa. 6. Los hombres dieron dinero á la madre del Americano. 7. Los carpinteros fueron á casa del pintor. 8. Los jueces escribieron cartas á la madre del pintor. 9. Los carpinteros de navío tienen dinero.

EXERCISE 4.

Translate into Spanish:—

1. The painters have money. 2. The women have husbands. 3. The carpenters gave a book to the son of the judge. 4. The daughters of the Frenchwoman wrote letters to the sons of the judge. 5. The physician wrote letters to the mother of the painter. 6. The male servants of the physician wrote letters to the female servants of the Frenchwoman. 7. The printers went to (the) house of the judge. 8 The horses are hungry. 9. The oxen are thirsty.

ELECTRICITY.—XIV.

[*Continued from p. 247.*]

THERMO-ELECTRICITY.

THE first discovery of a means by which a continuous current could be generated was made within a year or two of the close of the last century by Volta and Galvani, and from that discovery have sprung into existence our present enormous electrical industries. Little more than a score of years had passed when Seebeck announced, in 1821, a second and purely independent means by which the same object could be accomplished. He found by applying heat to the junction of two dissimilar metals that a current was generated, which flowed through the junction in a definite direction, depending upon the nature of the metals. He obtained the strongest effects when using the metals bismuth and antimony, and found that on the application of heat the current passed through the heated junction *from bismuth to antimony.* On the other hand, if the junction was cooled below the temperature of the remainder of the circuit, a current was also generated, but its direction through the junction was in the opposite direction to the previous one—it flowed *from antimony to bismuth.* A combination of two such metals is known as a "*thermo-electric couple,*" and the currents generated by them—though they differ in no way from any other currents—are called thermo-electric currents. In Fig. 73, two bars, one of antimony and one of bismuth, are shown joined directly at the point J, and joined at their remote ends by means of wires through a low resistance galvanometer G. On heating the junction J, a current circulates through the circuit in the direction indicated by the arrows, and its strength can be measured by the galvanometer; on cooling the junction the current flows in the opposite direction.

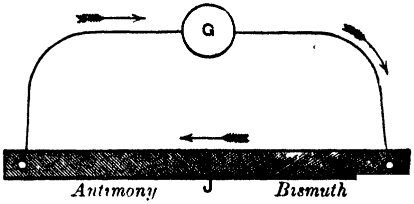

Fig. 73.—THERMO-ELECTRIC COUPLE.

It will be noticed in this diagram that the circuit does not consist wholly of bismuth and antimony, but contains a number of other metals, through which the current flows in the following order:—antimony, leading wire usually made of copper, brass terminal of galvanometer, coil of the galvanometer usually made of copper, second brass terminal, second leading wire, bismuth. The junctions of these metals would also give rise to E.M.F.s if at different temperatures; but we are considering them all as being at the same temperature, and the junction J alone heated.

Currents would also be obtained by using any other two metals, but—except in the cases of some of the rare metals—the effects would be smaller. Even in the case of bismuth and antimony the E.M.F. generated at the junction is extremely small, being only about 110 microvolts for 1° Cent. difference of temperature maintained between the hot and cold ends of the metals. (A microvolt is the one-millionth part of a volt.) In any circuit consisting of two metals, if one junction is heated whilst the remainder of the circuit is maintained at a fixed temperature, the E.M.F. generated increases with an increase of temperature, but does not increase proportionately. The following list shows the E.M.F. that would be generated by any pair of metals when the difference of temperature between the hot and cold junctions was 1° Cent., and when the mean temperature was about 20° Cent. (From experiments by Dr. Matthiessen.) :—

Metal.	E.M.F. in Microvolts.	Metal.	E.M.F. in Microvolts.
Bismuth (pressed commercial wire)	+ 97·0	Gold	− 1·2
Bismuth (pure pressed wire)	+ 89·0	Silver (pure hard)	− 3·0
Bismuth (crystal axial)	+ 65·0	Zinc (pure pressed)	− 3·7
Bismuth (crystal equatorial)	+ 45·0	Copper (pure)	− 3·8
Cobalt	+ 22·0	Antimony (commercial pressed wire)	− 6·0
Mercury	+ 0·42	Iron (piano wire)	− 17·5
Lead	+ 0·0	Antimony (crystal axial)	− 22·6
Tin	− 0·1	Antimony (crystal equatorial)	− 26·4
Copper (commercial)	− 0·1	Tellurium	− 502·0
Platinum	− 0·9	Selenium	− 807·0

In a thermo-electric couple made of any two of these metals, the direction of the current through the heated junction will be from the higher to the lower metal in this list, and the E.M.F. generated will be—for 1° Cent. of difference of temperature—the difference between the figures opposite to those metals. An example will make this clear.

Consider a couple made of pressed commercial bismuth wire and pressed commercial antimony wire.

The figure opposite pressed commercial bismuth wire is ... . + 97

The figure opposite pressed commercial antimony wire is ... ... − 6

Subtracting − 6 from + 97 we get 103 microvolts as the E.M.F. of the couple when the difference of temperature between the junctions is 1° Cent.; and the direction of the current through the hot junction is from bismuth to antimony, since bismuth stands higher on the list than antimony. When the numbers have both the sign + or both −, the E.M.F. can be found in a similar manner: thus, commercial copper has − 0·1, and iron piano wire has − 17·5; subtracting − 17·5 from − 0·1 we get a resultant E.M.F. of 17·4 microvolts for 1° Cent., and the direction of the current through the hot junction from iron to copper.

The experiments of Dr. Matthiessen, from which the above table is deduced, were made at a mean temperature of between 19° and 20° Cent., and the figures for the E.M.F.s are correct for that temperature only. At higher and lower temperatures the figures differ, and even the order in which the metals are arranged is changed. If we experiment with a couple consisting of copper and iron, by keeping one junction at zero and heating the other by known increments, we will obtain the following curious results: For the first degree difference of temperature we will get a certain E.M.F. in the circuit; for the second degree the E.M.F. will be increased, but not quite doubled; for the third degree the E.M.F. will be further increased, but will not be three times the original E.M.F., and so on—each degree increase of temperature adding on a certain amount of E.M.F., but the amount thus added on gets smaller and smaller as the temperature rises, till it has reached 275° Cent., when the E.M.F. in the circuit reaches a maximum. Any further increase of temperature will now diminish the E.M.F., and when it has reached 550° Cent. there will be no E.M.F. in the circuit. The temperature 275° Cent. is known as the *neutral point* for copper and iron. If the cold junction is the same number of degrees below the neutral point that the hot junction is above it, there will be no effective E.M.F. in the circuit; thus, if the cold junction is at a temperature of 100° Cent., and the hot junction at 350° Cent., or if the cold junction is at 270° Cent., and the hot junction at 280° Cent., there will be no effective E.M.F., and consequently no current generated in the circuit. On the other hand, if the hot junction is a greater number of degrees above the neutral point than the cold junction is below it, there will be an E.M.F., but in the reverse direction, and a current will flow through the circuit in the opposite direction to its previous course; this means that the order of copper and iron has been reversed on the above list. These facts are represented graphically in Fig. 74. In this figure the E.M.F. of the couple is represented vertically, and the temperature of the hot junction horizontally. The ordinates of the curved line represent the E.M.F. in the circuit for any temperature. It will be seen that starting at zero the E.M.F. rises with the temperature of the hot junction and attains a maximum at the neutral point 275° Cent., that it then diminishes and falls to zero at 550° Cent., and that it then increases in a negative direction, which means a reversal of the current in the circuit. It will also be seen that the increase of E.M.F. is not proportional to the difference of temperature between the two junctions, since if this was the case, the E.M.F. would rise and fall along the straight dotted lines.

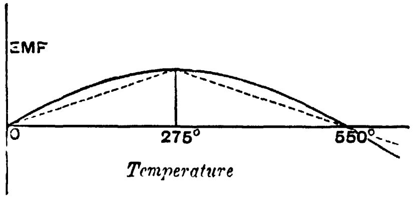

Fig. 74.

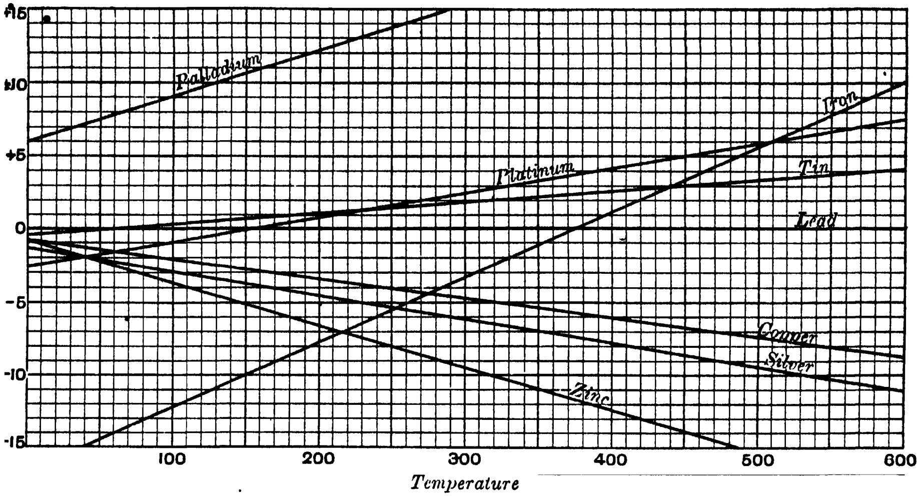

Fig 75.—THERMO-ELECTRIC DIAGRAM.

The same class of phenomena occur with any other two metals, though their neutral point may be at an extremely high or low temperature; in any case, we now see clearly that the thermo-electric series given in the table can only hold good for one fixed mean temperature. The relative thermo-electric powers of metals to each other at different temperatures can be best expressed by means of a diagram such as is shown in Fig. 75. Lead is assumed as the standard of reference, and the thermo-electric powers of the other metals are given at different temperatures with reference to it, and consequently with reference to each other. The lines are straight up to 500° or 600° Cent., and the point where any two intersect is the neutral point for those metals. Neither the bismuth nor antimony lines are shown on the diagram, for the reason that it would have to be considerably enlarged in order to bring them on it. It is quite easy to find the E.M.F. which would be generated by any pair of metals when the temperatures of the two junctions were known. Take the case of iron and copper with one junction at 50° Cent. and the other at 150° Cent., and for the sake of clearness put them on a diagram by themselves, Fig. 76. The E.M.F. generated under these conditions is the area of the trapezoid A B D C. If the cold junction is at 50° Cent., and the hot one at 275° Cent.—the neutral point—the E.M.F. is the area of the triangle A B T.

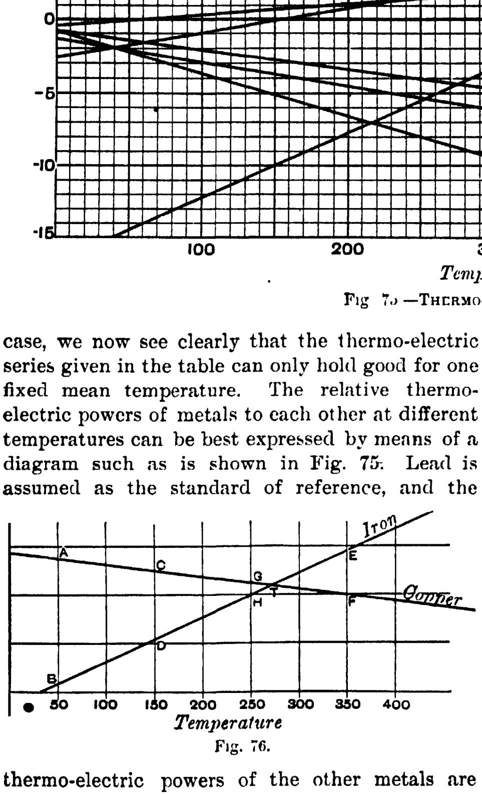

Fig. 76.

If the cold junction is at 50° Cent., and the hot one at 350° Cent.—above the neutral point—the E.M.F. is the area of the triangle A B T, minus the area of the triangle E F T.

If the temperature of the hot junction be still further raised, the area of the triangle beyond the neutral point increases, and becomes equal to the triangle to the left of the neutral point when both temperatures are equally distant from it; no effective E.M.F. is then generated in the circuit.

If the cold junction is at a temperature of 250° Cent., and the hot one at 350° Cent., the E.M.F. in circuit is the area of the triangle G H T, minus the area of the triangle E F T. As the latter is greater than the former, the resultant E.M.F. is a negative quantity; which means that iron and copper have changed places on the table, and that the current now flows through the hot junction from iron to copper. A similar inversion of the current takes place in the case of any other pair of metals when the hot junction is farther above their neutral point than the cold junction is below it.

We have now seen that if one junction of a pair of dissimilar metals is heated and the other cooled an electric current is generated in the circuit; this is known as the "Seebeck effect." The converse proposition is also true; if a current is sent through a circuit consisting of a pair of dissimilar metals, one junction will be heated and the other cooled; this is known as the "Peltier effect." In a bismuth and antimony couple, if the current flows from bismuth to antimony the junction will be cooled, whilst the junction through which the current flows from antimony to bismuth will be heated. Reversing the direction of the current interchanges the junctions which are heated and cooled. The Peltier effect is quite distinct from the ordinary heating effect of a current in passing through a resistance. The heating effect of a current in passing through a resistance is usually known as the "Joule effect"; it is independent of the nature of the material through which the current flows, provided the resistance is constant, and it is not reversible like the Peltier effect. The Joule effect in any circuit is expressed by the formula—

$$H = 0{\cdot}24\, C^2Rt$$

Where H = heat in calories.
„ C = current in amperes.
„ R = resistance in ohms.
„ t = time in seconds.

The Peltier effect in any circuit is expressed by the formula—

$$H = \pm\, 0{\cdot}24\, PCt$$

Where P = E.M.F. in volts due to the heating of the junction. This quantity P is known as the coefficient of the Peltier effect, and clearly has a different value for a junction of each pair of metals; it is equal to the work in ergs which is the equivalent of the heat evolved at that junction by the passage of one ampere through it.

The sign ± is inserted in the formula for the reason that heat may be absorbed or evolved according to the direction in which the current flows through the junction. From the above formula it is seen that in the Joule effect the heat is proportional to the *square of the current*, whereas in the Peltier effect the heat is proportional *simply to the current*. The complete heat law for any circuit must therefore be written in the form—

$$H = 0{\cdot}24\,(C^2Rt \pm PCt)$$

In a circuit consisting of two metals a current always heats one junction and cools the other. If the current is generated by the application of heat to one junction, it will in general flow in such a direction as to heat the cold junction and cool the hot one. Heat is thus absorbed at the hot junction in order to generate the current, and evolved at the cold junction; this explanation, however, is not complete, as was pointed out by Sir W. Thomson, since if one junction is at the neutral point the metals are then thermo-electrically identical, and no Peltier effect can occur; at the same time a current is generated in the circuit, provided the other junction is at a lower temperature than the neutral point, and the strength of this current increases as the temperature of the colder junction is diminished, whilst its direction will be such as to heat the colder junction and cool the hot one. If the generation of this current is due to heat absorbed by the metals from the external source—and it cannot be due to anything else—and if the metals are thermo-electrically identical at the neutral point—as they are—it is perfectly clear that the seat, or seats, of the E.M.F. cannot exist at the junction of the two metals, and must exist at some point, or points, in the metals themselves. This is found to be actually the case, and the heat, which is the equivalent of the current, is absorbed, not at the junction, but at various points along the metals themselves. Considering the case of a copper-iron couple, a current will flow from copper to iron across the hot junction, it will there pass through a rise of potential and will cool the junction; the same phenomenon occurs in the case of a single metal; thus, if a current is passed through an iron wire from a hot region to a cold one it cools the iron in the cold region; if sent in the opposite direction it heats the cold region. In the case of copper the heating effects of the current are reversed. This is known as the "Thomson effect." Hot iron is therefore thermo-electrically *positive* to cold iron, whilst hot copper is *negative* to cold copper. When a current is therefore generated with one junction at the neutral point, it is due to the E.M.F. of cold copper to hot copper, and hot iron to cold iron, and the total E.M.F. in the circuit is the sum of these two. If unit current is sent through the circuit the amounts of heat absorbed by the metals are shown in Fig. 77. In

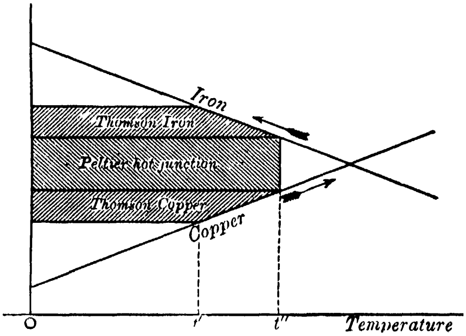

Fig. 77.

this figure the area marked "Peltier hot junction" represents the amount absorbed at the hot junction, the area marked "Thomson iron" represents the Thomson effect in the iron, and the area marked "Thomson copper" the Thomson effect in the copper. From this diagram it is seen that if the hot junction is at the neutral point the area marked "Peltier hot junction" vanishes, or that there is no Peltier effect.

LATIN.—XXXV.

[*Continued from p.* 257.]

THE AGRICOLA OF TACITUS (*continued*).

The Speech of Galgacus to his Followers (*continued*).

31. "Liberos cuique ac propinquos suos natura carissimos esse voluit: hi per dilectus alibi servituri auferuntur: conjuges sororesque etiam si hostilem libidinem effugiant, nomine amicorum atque hospitum polluuntur. Bona fortunaeque in tributum, ager atque annus in frumentum, corpora ipsa ac manus silvis ac paludibus emuniendis inter verbera ac contumelias conteruntur. Nata servituti mancipia semel veneunt, atque ultro a dominis aluntur: Britannia servitutem suam quotidie emit, quotidie pascit. Ac sicut in familia recentissimus quisque servorum etiam conservis ludibrio est, sic in hoc orbis terrarum vetere famulatu novi nos et viles in excidium petimur; neque enim arva nobis aut metalla aut portus sunt, quibus exercendis reservemur. Virtus porro ac ferocia subjectorum ingrata imperantibus; et longinquitas ac secretum ipsum quo tutius, eo suspectius. Ita sublata spe veniae tandem sumite animum, tam quibus salus quam quibus gloria carissima est. Brigantes femina duce exurere coloniam, expugnare castra, ac nisi felicitas in socordiam vertisset, exuere jugum potuere: nos integri et indomiti et in libertatem, non in patientiam bellaturi, primo statim congressu ostendamus, quos sibi Caledonia viros seposuerit.

32. "An eandem Romanis in bello virtutem quam in pace lasciviam adesse creditis? Nostris illi dissensionibus ac discordiis clari vitia hostium in gloriam exercitus sui vertunt; quem contractum ex diversissimis gentibus ut secundae res tenent, ita adversae dissolvent: nisi Gallos et Germanos et (pudet dictu) Britannorum plerosque, licet dominationi alienae sanguinem commodent, diutius tamen hostes quam servos, fide et adfectu teneri putatis. Metus ac terror sunt infirma vincla caritatis; quae ubi removeris, qui timere desierint, odisse incipient. Omnia victoriae incitamenta pro nobis sunt: nullae Romanos conjuges accendunt, nulli parentes fugam exprobraturi sunt; aut nulla plerisque patria aut alia est. Paucos numero, trepidos ignorantia, caelum ipsum ac mare et silvas, ignota omnia circumspectantes, clausos quodam modo ac vinctos di nobis tradiderunt. Ne terreat vanus aspectus et auri fulgor atque argenti, quod neque tegit neque vulnerat. In ipsa hostium acie inveniemus nostras manus. Adgnoscent Britanni suam causam, recordabuntur Galli priorem libertatem: deserent illos ceteri Germani, tam quam nuper Usipi reliquerunt. Nec quicquam ultra formidinis: vacua castella, senum coloniae, inter male parentes et injuste imperantes aegra municipia et discordantia. Hic dux, hic exercitus ibi tributa et metalla et ceterae servientium poenae, quas in aeternum perferre aut statim ulcisci in hoc campo est. Proinde ituri in aciem et majores vestros et posteros cogitate."

The Speech of Agricola.

33. Excepere orationem alacres, ut barbaris moris, cantu fremituque et clamoribus dissonis. Jamque agmina et armorum fulgores audentissimi cujusque procursu: simul instruebatur acies, cum Agricola quamquam laetum et vix munimentis coërcitum militem accendendum adhuc ratus, ita disseruit: "Octavus annus est, commilitones, ex quo virtute vestra, auspiciis imperii Romani, fide atque opera nostra Britanniam vicistis. Tot expeditionibus, tot proeliis, seu fortitudine adversus hostis seu patientia ac labore paene adversus ipsam rerum naturam opus fuit, neque me militum neque vos ducis paenituit. Ergo egressi, ego veterum legatorum, vos priorum exercituum terminos, finem Britanniae non fama nec rumore, sed castris et armis tenemus: inventa Britannia et subacta. Equidem saepe in agmine, cum vos paludes montesve et flumina fatigarent, fortissimi cuiusque voces audiebam: 'Quando dabitur hostis, quando acies?' Veniunt, e latebris suis extrusi, et vota virtusque in aperto, omniaque prona victoribus atque eadem victis adversa. Nam ut superasse tantum itineris, silvas evasisse, transisse aestuaria pulchrum ac decorum in frontem, ita fugientibus periculosissima quae hodie prosperrima sunt; neque enim nobis aut locorum eadem notitia aut commeatuum eadem abundantia, sed manus et arma et in his omnia. Quod ad me attinet, jam pridem mihi decretum est neque exercitus neque ducis terga tuta esse. Proinde et honesta mors turpi vita potior, et incolumitas ac decus eodem loco sita sunt; nec inglorium fuerit in ipso terrarum ac naturae fine cecidisse.

34. "Si novae gentes atque ignota acies constitisset, aliorum exercituum exemplis vos hortarer: nunc vestra decora recensete, vestros oculos interrogate. Hi sunt, quos proximo anno unam legionem furto noctis adgressos clamore debellastis; hi ceterorum Britannorum fugacissimi ideoque tam diu superstites. Quo modo silvas saltusque pene-

trantibus fortissimum quodque animal contra ruere, pavida et inertia ipso agminis sono pelluntur, sic acerrimi Britannorum jam pridem ceciderunt, reliquus est numerus ignavorum et metuentium. Quos quod tandem invenistis, non restiterunt, sed deprehensi sunt; novissimae res et extremo metu torpor defixere aciem in his vestigiis, in quibus pulchram et spectabilem victoriam ederetis. Transigite cum expeditionibus, imponite quinquaginta annis magnum diem, adprobate rei publicae numquam exercitui imputari potuisse aut moras belli aut causas rebellandi."

Agricola's Tactics.

35. Et adloquente adhuc Agricola militum ardor eminebat, et finem orationis ingens alacritas consecuta est, statimque ad arma discursum. Instinctos ruentesque ita disposuit, ut peditum auxilia, quae octo milium erant, mediam aciem firmarent, equitum tria milia cornibus adfunderentur. Legiones pro vallo stetere, ingens victoriae decus citra Romanum sanguinem bellanti, et auxilium, si pellerentur. Britannorum acies in speciem simul ac terrorem editioribus locis constiterat ita, ut primum agmen in aequo, ceteri per adclive jugum convexi velut insurgerent; media campi covinnarius eques strepitu ac discursu complebat. Tum Agricola superante hostium multitudine veritus, ne in frontem simul et latera suorum pugnaretur, diductis ordinibus, quamquam porrectior acies futura erat et arcessendas plerique legiones admonebant, promptior in spem et firmus adversis, dimisso equo pedes ante vexilla constitit.

The Battle and the Defeat of the Caledonians.

36. Ac primo congressu eminus certabatur: simulque constantia, simul arte Britanni ingentibus gladiis et brevibus cetris missilia nostrorum vitare vel excutere, atque ipsi magnam vim telorum superfundere, donec Agricola Batavorum cohortes ac Tungrorum duas cohortatus est, ut rem ad mucrones ac manus adducerent; quod et ipsis vetustate militiae exercitatum et hostibus inhabile, parva scuta et enormes gladios gerentibus; nam Britannorum gladii sine mucrone complexum armorum et in arto pugnam non tolerabant. Igitur ut Batavi miscere ictus, ferire umbonibus, ora fodere, et stratis qui in aequo adstiterant, erigere in colles aciem coepere, ceterae cohortes aemulatione et impetu connisae proximos quosque caedere: ac plerique semineces aut integri festinatione victoriae relinquebantur. Interim equitum turmae, ut fugere covinnarii, peditum se proelio miscuere. Et quamquam recentem terrorem intulerant, densis tamen hostium agminibus et inaequalibus locis haerebant; minimeque equestris jam pugnae facies erat, cum aegre clivo instantes simul equorum corporibus impellerentur; ac saepe vagi currus, exterriti sine rectoribus equi, ut quemque formido tulerat, transversos aut obvios incursabant.

NOTES TO TACITUS (*continued*).

Chap. XXXI.—*Per dilectus.* "By conscriptions."

Bona fortunaeque. *Fortunae* is here used in a concrete sense, just as the cognate word usually is in English. The expression is redundant, as *fortunae* adds but little to the meaning of *bona*. Similarly *ager et annus* means nothing more than "crops."

Emuniendis. *Emunire* means "to defend" and so "to make passable." Here it has one meaning with *silvis*, and a slightly different one with *paludibus*. Translate, "by clearing forests and draining swamps."

Mancipium. In Roman law *mancipium* is a formal method of sale, in which the object sold is taken in the hand and the money weighed out. Hence *mancipium* comes to mean that which is sold in accordance with this custom, and particularly a "slave."

Servitutem. Concrete, not abstract. "Britain is purchasing every day, and every day is feeding her own slaves."

Novi nos et viles. "We, as late comers and worthless slaves." It should be remembered that throughout the speech Galgacus is represented as contrasting the Caledonians, not with Gauls or Teutons, but with the other tribes of Britons.

Femina duce. Here Boadicea is referred to.

Chap. XXXII.—*Nostris dissensionibus ac discordiis.* These words must be taken with *clari*. "Famous through our quarrels and discords."

Nisi. This clause is ironical. "Unless (as, of course, you don't)," etc.

Aut nulla plerisque patria aut alia est. The Roman army contained many foreigners, many Britons even, as was explained in a previous chapter. *Alia* means "other than this," *i.e.*, "one far distant."

Nostras manus. "Our own troops."

Nec quicquam ultra formidinis. "Beyond there is no cause of fear."

Senum coloniae. The able-bodied had taken the field; the colonies were left in the hands of men too old for active service.

Chap. XXXIII.—*Excepere orationem.* That so polished and eloquent a speech should be received with discordant shouts is not a little remarkable, and the statement emphasises the unreality of the speech which Tacitus has put into the mouth of the Caledonian leader.

Jamque agmina, etc. "Now the line formed and there was seen the glitter of arms, as the boldest of the warriors advanced."

Ergo egressi. The conquest of Britain, says Agricola, is no longer a matter of hearsay or report. He, with his army, has advanced farther than his predecessors, and holds the country by force.

In agmine. "On the march."

Quando acies. "When will be the battle?" *Acies*, as you have already learnt, means an army drawn up in battle array.

Vota virtusque in aperto. "Your wishes and bravery have an open field."

In frontem. "So long as we present our front to the foe."

The phrase may not be more briefly rendered. It is opposed to the word *terga* a few lines lower down.

Quod ad me attinet. "For my own part, I have long made up my mind that retreat is safe neither for army nor leader."

Chap. XXXIV.—*Novae gentes.* "Strange tribes."

Acies is the army of the Caledonians drawn up for the fight.

Vestra decora. "Your great achievements."

Unam legionem. An account of the surprise of the 9th legion will be found in Chap. XXVI.

Debellastis. This is a strong word, when a shout won the victory. The *de* implies that the Caledonians were utterly crushed.

Numerus. This must not be translated by "number." Both in Latin and English it is a vulgarism to speak of "a number of cowards," and *numerus* means a *mere* number. It may here be translated by "rabble."

Quos quod invenistis. Turn the sentence thus: "You have found them not because. . . ."

Torpor. In some editions *corpora* is read. But *torpor* is better: "the inaction which springs from extreme fear."

Edere. *Edere* means "to set forth," "to display," and *edere victoriam* is a strange expression.

Transigite. *Transigere* means "to bring to an end," "to settle." It is especially used of bringing an action at law to an end. "Have done with campaigns."

Chap. XXXV.—*Alacritas.* "Enthusiasm." You will notice that Tacitus uses the same word to describe the effect of the eloquence of Galgacus and Agricola.

Adfunderentur. This is a strange expression. It means little more than "were added."

Ingens decus. In opposition to *legiones.*

Citra. This preposition means "on this side of," "short of," and so "without." In this last sense, in which it is used in the present passage, it rarely occurs, and not in Latin of the classical period.

Covinnarius eques. "Knights in chariots." The phrase gives rise to confusion, as there is no force in *eques.* The Britons can hardly have mounted their cavalry in chariots.

Media campi. "The plain between the two armies."

Diductis ordinibus. "The ranks being widened."

Chap. XXXVI.—*Constantia.* "Firmness."

Cetras. *Cetrae* were small shields or bucklers. The word is said to be of Spanish origin.

Batavorum. The cohorts of the Dutch are frequently mentioned by Tacitus as being plucky, spirited troops.

Tungrorum. The *Tungri* were a tribe of *Gallia Belgica,* and inhabited the country near the modern Tongres.

Quod. "Which method of attack."

Mucrone. The strict meaning of *mucro,* which it bears in this place, is a "point," especially a sword's point. Hence it is frequently used for a sword, as it is a few lines above.

Ora fodere. This is a singularly realistic expression, and resembles the English colloquial phrase "to dig in the eye."

Integri. "Sound," "unwounded."

Equitum turmae. This passage is a little obscure and the editors are doubtful whether *turmae* refers to the Romans or Caledonians: it probably means the former. *Turma* has a strictly technical meaning; it is the tenth part of an *ala,* and consisted of thirty men.

Transversos aut obvios. Messrs. Church and Brodripp translate these words "sideways, or in direct collision."

KEY TO TACITUS (*continued*).

22. During the third year of his command, he discovered new people, by continuing his devastations through the several nations as far as the mouth of the Tyne: so the firth is called. Whence such terror seized the foe that they durst not attack our army, though it was shaken by terrible tempests: and there was even time for erecting forts. Men trained in war observed that never had any leader more sagely chosen favourable spots, or that no place of strength founded by him was ever taken by violence, or abandoned by compact or by flight. Frequent excursions were made; for, against any long siege they were supplied with a year's provisions. Thus they passed the winter there without apprehension: each held his own fort, so that the enemies were baffled, and in despair; for being wont to repair their losses in the summer by their success in the winter, they now were defeated winter and summer alike. Neither did Agricola ever arrogate to himself the glory of exploits performed by others; centurion or commander of a legion was sure to find him a sincere witness of his achievement. By some he is said to have been over sharp in his reproofs, and as he was courteous to the good so he was stern to the bad. But from his anger no malice remained so that you had silence to fear. More honourable he thought it to give open offence than to foster secret hate.

23. The fourth summer was spent in rendering secure those parts of the country which he had hastily traversed; indeed, would the bravery of the armies and the glory of the Roman name have suffered it, there had been then found in Britain itself a boundary to our conquests. For the firths of Clyde and Forth are driven by the tides of the opposite sea so far up the country that they are parted only by a narrow neck of land. This was now secured with garrisons, and of all on this side we were already masters; since the enemy were driven, as it were, into another island.

24. In the fifth year of the war, Agricola passing the firth, himself in the first ship (that ever visited Ireland), in many and successful encounters subdued nations till that time unknown, and furnished with troops that part of Britain which looks upon Ireland, more in the hope of conquest than from any present fear. In truth Ireland, as it lies just between Britain and Spain, and is capable of an easy communication with the coast of Gaul, would have linked together these powerful limbs of the Empire with great mutual benefits. In size it is inferior to Britain, but surpasses the islands in our sea. In soil and climate, as also in the temper and manners of the natives, it varies little from Britain. Its interior is little known; its ports and landings far better, through the frequency of commerce and merchants. A petty king of the country, expelled by domestic dissension, was already received into protection by Agricola, and, under the appearance of friendship, reserved for a proper occasion. By him I have often heard it declared, that with a single legion and a few auxiliaries Ireland might be conquered and preserved; nay, that such an acquisition were of moment for the securing of Britain, if, on all sides the Roman arms were seen, and all national liberty banished, as it were, out of sight.

25. For the rest, on the summer which began the sixth year of his administration, as it was apprehended that the nations forward would universally take arms, and that the ways were all infested with the enemy's host, having coasted the large states beyond the Forth, he explored the harbours with his fleet, which was from the beginning employed by him as part

of his forces, and attended him with imposing effect when thus by sea and land the war was urged. In truth, the same camp often contained the foot and the horse and the marines, joyously sharing the same meals, severally magnifying their own feats, their own hazards and adventures, and they compared with a soldier's arrogance, now the depths of mountains and forests, now the outrages of waves and tempests; here their exploits by land and against the foe, there the vanquished ocean. Upon the Britons also, as from the captives was learnt, the sight of the fleet brought much consternation and dismay; as if, now that their solitary ocean and recesses of the deep were disclosed and invaded, the last refuge of the vanquished was cut off. To arms the several peoples inhabiting Caledonia had immediate recourse, and advancing with great parade, made still greater by common rumour (as usual in things that are unknown), assailed our forts unprovoked, and created much fear and alarm as issuing the challenge. Nay, the timid, under the pretence of being prudent, exhorted a return to the nether side of the Forth, for that it were better to retire back than to be driven, when in the meanwhile he ascertained that the enemy meant to attack him in divers bands. And lest he should be surrounded on account of their superior numbers and knowledge of the country, he too advanced with his army divided into three parts.

26. As soon as this disposition of his was known to the enemy, they suddenly changed theirs, and all in a body proceeded to fall upon the ninth legion as the weakest of all; and, as the assault was in the night, they slew the guards and entered the trenches, aided by the general sleep or general dismay there. The battle was being fought in the camp itself, when Agricola, having from his scouts learnt what route the enemy had taken, and closely following their track, commanded the lightest of his foot and cavalry to charge them, whilst yet engaged, in the rear, and the whole army presently after to give a mighty shout. Moreover, at the approach of dawn, the Roman banners were beheld refulgent. Thus were the Britons dismayed with double peril and distress; and to the Romans their courage returned. Hence, seeing their lives secure, they now maintained the conflict for glory. They even returned the attack upon the enemy, insomuch that in the very gates of the camp a bloody encounter ensued, till the enemy was quite routed; for both these our armies exerted their might, the one contending to show that they had brought relief, the other to appear not to have wanted assistance. Indeed, had not the woods and marshes served for shelter to the fugitives, by this victory the war had been finished.

27. By the knowledge and renown of this victory, the army cried "That nothing stood in the way of their bravery. They must penetrate into the heart of Caledonia, and advance in a continual succession of battles, till they had at last found the utmost limits of Britain." Thus it was that they who a little before had been so wary and so wise, were now, after the event, grown full of boasts and intrepidity. The lot of warfare is very unequal, in success all men assume part, the disasters are all imputed to one. Now the Britons, conjecturing the victory to proceed not from superior courage, but from opportune action improved and the address of our General, lost nothing of their spirit and defiance, but armed their young men, removed their wives and children into places of security, and in general conventions of their several communities engaged them in a confederacy ratified by solemn sacrifices. And thus they mutually retired for the winter, with minds on both sides abundantly irritated.

28. During the same summer a cohort of Usipians, levied in Germany and thence transported to Britain, adventured upon a desperate and memorable feat. When they had slain the centurion and soldiers placed amongst them for training them in discipline, and to serve them for patterns and directors, they embarked in three pinnaces, forcing the pilots to conduct them, and one undertaking the navigation, they suspected and put to death the other two. As the attempt was not yet divulged, their launching into the deep was beheld as a wonder. Anon, having landed for the purpose of getting water and seizing the necessaries of life, and having engaged with many Britons, who defended their own property, they frequently proved victorious, and were sometimes defeated: they were at last reduced to want so pressing as to feed upon one another, first upon the weakest, then upon whomsoever the lot fell. In this manner they were carried round about Britain, and having lost their vessels through ignorance how to manage them, they were accounted robbers and pirates, and fell into the hands first of the Suevians, afterwards of the Frisians. Nay, as they were bought and sold for slaves, some of them, through change of masters, were brought over to our side of the Rhine, and were rendered famous from the discovery of an adventure so extraordinary.

29. In the beginning of the summer, Agricola suffered a sore blow in his family by losing his son, born about a year before. A misfortune which he neither bore with an ostentation of firmness and unconcern, like many other men of magnanimity, nor, on the contrary, with lamentations and tears worthy only of women. Besides, for this affliction war proved one of his reliefs. When, therefore, he had sent forward the navy, which by committing devastations in several places would not fail to spread a mighty and perplexing terror, he put himself at the head of his army unimpeded by baggage, and to it had added some of the bravest Britons, such as had been well proved through a long course of peace. Thus he arrived at the Grampian Hills, upon which the enemy were already encamped. For the Britons, nothing daunted by the issue of the former battle, and determined to take vengeance or to accept bondage, taught withal at last that a general union was the best way to repel common danger, had by embassies and confederacies drawn together the forces of all their communities. Even then were to be seen thirty thousand men in arms, and their youth from every quarter were still flocking in, as were also such of their elderly men as were yet fresh and green, they who were signal in war, and now carried with them their several ensigns of honour. And now Galgacus, who amongst their several leaders surpassed all in valour and descent, is said to have spoke in this strain to the multitude which was pressing for battle:

30. "Whenever I contemplate the causes of the war, and our unavoidable position, I am quite hopeful that this day and this union of yours will prove the beginning of universal liberty to Britain. For we have never endured slavery, and beyond us there is no further land; nor in truth is the sea secure whilst the Roman fleet is hovering upon our coasts. Thus battle and arms which prove honourable to brave men, are to cowards too become the safest of all expedients. The former battles, in which with varying fortune war was urged with the Romans, had still a hope of succour in this our nation. For of all the people of Britain we are the best bred, and then placed in its innermost regions, and, as we do not look upon the coasts of such as are slaves, we thus preserve even our eyes free from the sight of tyranny. To us who inhabit the confines of the world and liberty, this extremity of the globe, this hiding-place of fame, has to this day proved the only defence. All that is unknown appears imposing. But now the utmost boundary of Britain is laid open. Beyond us no more people are found, nor aught save seas and rocks, and, still more, the deadly Romans, from whose tyranny you will not escape by obedience and moderation. Plunderers of the earth, who in their universal devastations finding countries to fail them, even spy out the sea. If the enemy be wealthy, he inflames their avarice; if poor, their ambition. They are general spoilers, such as neither the Eastern world nor the Western can satiate. They only of all men thirst after wealth

and poverty with equal passion. To spoil, to butcher, and to commit every kind of violence, they style by a lying name, *Government*; and where they spread solitude, they call it *Peace*."

GREEK.—XII.

[*Continued from p.* 262.]

CONJUGATION.—PRELIMINARY NOTIONS.

Let us take the word ἐλυσάμην to illustrate what was said in the last lesson. The word signifies *I loosed myself* (*I untied* or *unbound myself*). Now suppose that *I unloosed myself* was written as though it formed one word, as thus:—*Iunloosedmyself*. If we mark off the several elements of this compound by hyphens, and assign names to the several parts,

Personal Prefix.	*Adverbial Prefix.*	*Tense Stem.*	*Personal Suffix.*
I	un-	loosed	myself,

we may have some idea how the Greek form above presented has been produced. Here it is divided, and the parts named—

Augment.	*Aorist Stem.*	*Euphonic Vowel.*	*Middle Personal Ending.*
ἐ-	λυσ-	α-	-μην.

The root of the form is λυ, and it remains permanent under all the modifications. Thus it is found in λύσω, in λυσόμενος, ἐλύθην, etc. By prefixing certain letters to λυ, and by adding certain letters to λυ, we get all the varieties of form and signification. Thus, if we want to say *I loose*, we add ω, as λύ-ω; if we want to say *they loosed*, we prefix ἔ and add σ-αν, thus ἔ-λυ-σ-αν. The prefixes and suffixes by whose aid the root is thus modified may be termed formative syllables. A knowledge of these formative syllables, combined with a knowledge of the several roots, is necessary for a correct knowledge of the grammar of the verbs.

THE AUGMENT.

First of all, we must consider the augment. We may distinguish two forms which it assumes—called respectively (i.) syllabic and (ii.) temporal—according as the verb begins with (i.) a consonant or (ii.) a vowel. The syllabic augment (so called because it adds a syllable to the verb) is of two kinds—simple, and reduplicative. For instance, it is simple when it merely prefixes a vowel, as in ἔλειπον, *I was leaving*; it is reduplicative when it doubles the initial consonant, as λέλυκα. Here ε is called the simple syllabic augment, and λε the reduplicative. If the verb begins with a vowel, the temporal augment is used, the vowels α and ε being changed into η or ει; ῐ and ῠ (*iota* short and *upsilon* short) into ῑ and ῡ; ο into ω. In the same way the initial diphthongs αι, ει, οι are changed into ῃ, ῳ, the first vowel being changed into its corresponding long one, and the ι written underneath, while αυ becomes ηυ. If a verb begins with ρ, the ρ is generally doubled, as ῥίπτω, *I throw*, ἔῤῥιπτον. The simple syllabic augment is found only in the indicative mood; the reduplicative extends through all the moods. The simple syllabic augment is used with the imperfect tense and with the aorist. The reduplicative augment is used with the perfect tense, the pluperfect tense, and the third future, sometimes called the paulo-post-future. If, however, the verb begins with a vowel, the perfect and the pluperfect have, instead of the reduplicative, merely the temporal augment. The pluperfect has a double augment, inasmuch as it prefixes the simple augment ε to the reduplicative: for instance, ἐτετύφη.

CHARACTERISTIC LETTERS.

We have used previously the term *pure verbs*. This is one class into which verbs are divided; for verbs are divided into classes, according to the final letter of the verb-stem, just as we have seen that nouns may be grouped according to the final letters of their stems. And as with nouns, so with verbs, the two great classes are:—

(1) Those whose stems end in a vowel.
(2) Those whose stems end in a consonant.

The first class can easily be recognised, but the terminations of consonant-stems undergo such various changes in the formation of the present tenses that we can only direct the student's attention to the classification in the following pages. Thus, in λύω, υ is the characteristic of the verb; in τύπτω, π is the characteristic of the verb; and in στέλλω, λ is the characteristic of the verb. If the characteristic is a vowel, the verb is called *pure*, *e.g.*, λύω; if the characteristic is a consonant, the verb is called *mute*, *e.g.*, τύπτω; if the characteristic is a liquid, the verb is called *liquid*, *e.g.*, στέλλω, *I send*. Thus there are three kinds of verbs:—

Pure.	*Mute.*	*Liquid.*
τιμάω, *I honour.*	τρίβω, *I rub.*	φαίνω, *I show.*

FLEXIONAL TERMINATIONS.

Another kind of characteristic letters or syllables are the inflexions which mark the time (tense), the manner (mood), and the persons of the verb. Look at λύσομαι, *I will loose myself*. Analyse it, and the parts will be found to stand thus:—

Root.	*Tense Sign.*	*Mood Sign.*	*Person Sign.*
λυ-	σ-	ο-	μαι.

Here λυ- is the root, σ is the characteristic of the future, ο of the indicative mood, and -μαι of the first person singular. Let us vary these forms a little.

Root.	*Tense Sign.*	*Mood Sign.*	*Person Sign.*
λυ-	σ-	οι-	μεθα.

Here the sign of the indicative mood, ο, has become οι, to indicate the optative, and -μαι of the first person singular is changed into -μεθα of the first person plural. Again, take ἐλύσαντο.

Augment.	*Stem.*	*Tense Sign.*	*Mood Sign.*	*Person Sign.*
ε-	λυ-	σ-	α-	ντο.
βε-	βουλευ-	σ-	ο-	μαι.
ε-	βουλευ-	σ-	α-	μην.

Augment.	*Stem.*	*Voice Sign.*	*Person Sign.*
ε-	βουλευ-	θ-	ην.

The tense sign, in union with the person sign, is termed the tense-ending. Thus in λύσω the σ is the tense sign, being the sign of the future, and σω is the ending of the future tense, active voice, commonly called the future active. The stem of the verb, in connection with the tense sign and with the augment, is called the tense-stem. Thus, in ἐβούλευσα the tense-stem is ἐβουλευσ- (that is, the stem of the first aorist active).

GENERAL TABLE OF THE TENSE-ENDINGS.

	Active.	*Middle.*	*Passive.*
Present.	-ω.	-ομαι.	
Imperfect.	-ον.	-ομην.	
Perfect.	-α.	-μαι.	
Pluperfect.	-ειν.	-μην.	
First Aorist.	-σα.	-σαμην.	-θην.
First Future.	-σω.	-σομαι.	-θησομαι.
Second Aorist.	-ον.	-ομην.	-ην.
Second Future.			-ησομαι.

PERSONAL ENDINGS AND VOWEL SIGNS.

The personal endings are the terminations by which the variations of person are indicated. They are closely connected with the mood signs, which are the vowels that indicate the several moods. For example:—

1 P. Sing. Ind. Pres. M.,	βουλεύ-ο-μαι.	Subj.,	βουλεύ-ω-μαι.
3 P. Sing. Ind. Fut.,	βουλεύ-σ-ε-ται.	Opt.,	βουλεύ-σ-οι-το.
1 P. Plur. Ind. Pres.,	βουλεύ-ο-μεθα.	Subj.,	βουλευ-ώ-μεθα.
2 P. Plur. Ind. Pres.,	βουλευ-ε-σθε.	Subj.,	βουλεύ-η-σθε.
1 P. Sing. Ind. 1 Aor.	ἐβουλευ-σ-ά-μην.	Subj.,	βουλεύ-σ-ω-μαι.
3 P. Sing. Ind. 1 Aor.	ἐβουλεύ-σ-ατο.	Opt.,	βουλεύ-σ-αι-το.

In these instances βουλευ- is the verb-stem, and ἐβουλευσ- is the first aorist tense-stem, while βουλευσ- is the stem of the future. The personal endings are -μαι, -ται, -μεθα, -το, etc.; and the mood-signs are the vowels ο, ω, ε, η, α, αι. It may be noticed that the short vowels represent the indicative, and that these short vowels are changed into their corresponding long ones for the subjunctive; also that ι enters as an essential into the optative forms, as in βουλεύσοιτο and βουλεύσαιτο. These two tenses are evidently very near in form, differing in this only, that the latter has an α where the former has an ο.

The personal endings join on immediately to the mood-signs, and unite so closely with them that they are blended together, and may appear as one. For example, βουλεύσ-ῃς, instead of βουλεύση-ις, and βουλεύ-ῃ instead of βουλεύ-ε-αι.

The distinction between the principal tenses and the historic tenses is important. The principal tenses (that is, the present, the perfect, and the future) of all moods but the optative form the third person of the dual in -ον, as βουλεύ-ε-τον, βουλεύ-ε-τον, βουλεύ-ε-σθον, βουλεύ-ε-σθον; while the historic tenses of all the moods and all the tenses of the optative mood form the third person in -ην, as ἐβουλεύ-ε-τον, ἐβουλευ-έ-την, ἐβουλεύ-ε-σθον, ἐβουλευ-έ-σθην. Further, the principal tenses form the third person plural, active voice, with the termination -σι (which is altered for the sake of euphony from -ντι, -νσι, the loss of ν being compensated by modification of the preceding vowel), which before a vowel becomes -σιν, and the third person plural middle with -νται; but the historic or secondary tenses have in the active -ν, and in the middle -ντο; as:—

βουλεύ-ο-νσι = βουλεύ-ουσι(ν).	ἐ-βούλευ-ο-ν.
βουλεύ-ο-νται.	ἐ-βουλεύ-ο-ντο.

Lastly, the principal tenses in the singular of the present middle run thus, -μαι, -σαι, -ται; but the historic tenses thus, -μην, -σο, -το; as:—

βουλεύ-ο-μαι.	ἐ-βουλευ-ό-μην.
βουλεύ-ε-σαι = βουλεύ-ῃ.	ἐ-βουλεύ-ε-σο = ἐ-βουλεύ-ου.
βουλεύ-ε-ται.	ἐ-βουλεύ-ε-το.

The student will, however, probably learn these endings more readily from a practical example, and accordingly we pass at once to the conjugation of a pure verb, marking the component parts of the different tenses and moods by hyphens, so that they may be discerned at a glance.

VERBS IN -Ω.

THE PURE VERB λύω, *I loose* (ACTIVE VOICE).

The Greek λύω and the English *loose* are obviously connected in form as well as in meaning. From the same root is our *to lose*, which is the same word as *loose*, differently spelt and pronounced. *To lose* is the effect of *loosing*.

We give in full, as an example of the first class of verbs (with vowel-stem), the conjugation of the verb λύω, *I loose* or *unbind*. But as the pure verbs do not possess the second tenses (that is, the second perfect active, the second pluperfect active, the second future passive, and the second aorist active, middle, and passive), examples of these second forms are taken from two mute verbs, namely, τρίβω, *I rub*, and λείπ-ω (root λιπ-), *I leave;* and from one liquid verb, namely, φαίν-ω (root φαν-), *I show*. By this means a complete example is presented.

We must premise that the English equivalents given to the various parts of the verb are only approximately correct. In particular, it should be observed that the aorist only denotes past time in the indicative (and to some extent in the participle), and in other moods when it is used in *Oratio Obliqua* to represent an aorist indicative of *Recta*. Generally, the only difference between the present and aorist, except in the indicative, is the difference between a *continuous* or *repeated* action and a *simple occurrence* of the action.

CONJUGATION OF A PURE VERB IN -ω.

Active Voice.—Paradigm.

INDICATIVE MOOD.

Present.—Stem λυ-.

Sing. 1. λύω,* *I loose* or *am loosing.*
2. λύ-εις, *thou art loosing.*
3. λύ-ει, *he is loosing.*
Dual. 2. λύ-ετον,* *you two are loosing.*
3. λύ-ετον,* *they two are loosing.*
Plur. 1. λύ-ομεν, *we are loosing.*
2. λύ-ετε,* *you are loosing.*
3. λύ-ουσι, *they are loosing.*

Imperfect.—Stem ε-λυ-.

Sing. 1. ἔ-λυ-ον,* *I was loosing.*
2. ἔ-λυ-ες, *thou wast loosing.*
3. ἔ-λυ-ε, *he was loosing.*
Dual. 2. ἐ-λύ-ετον, *you two were loosing.*
3. ἐ-λυ-έτην, *they two were loosing.*
Plur. 1. ἐ-λύ-ομεν, *we were loosing.*
2. ἐ-λύ-ετε, *you were loosing.*
3. ἔ-λυ-ον,* *they were loosing.*

	Future.—Stem λυ-σ-.		*First Aorist.*—Stem ε-λυ-σ-.
Sing. 1.	λύ-σ-ω,* *I shall loose*, etc.		ἔ-λυ-σ-α, *I loosed*, etc.
2.	λύ-σ-εις.		ἔ-λυ-σ-ας.
3.	λύ-σ-ει		ἔ-λυ-σ-ε.
Dual. 2.	λυ-σ-, etc.	*Like the Present.*	ἐ-λύ-σ-ατον.
3.	λυ-σ-		ἐ-λυ-σ-άτην.
Plur. 1.	λυ-σ-		ἐ-λύ-σ-αμεν.
2.	λυ-σ-		ἐ-λύ-σ-ατε.
3.	λυ-σ-		ἔ-λυ-σ-αν.

	First Perfect.—Stem λε-λυ-κ-.	*First Pluperfect.*—Stem ε-λε-λυ-κ-.
Sing. 1.	λέ-λυ-κ-α, *I have loosed*, etc.	ἐ-λε-λύ-κ-η, *I had loosed*, etc.
2.	λέ-λυ-κ-ας.	ἐ-λε-λύ-κ-ης.
3.	λέ-λυ-κ-ε.*	ἐ-λε-λύ-κ-ει.
Dual. 2.	λε-λύ-κ-ατον.*	ἐ-λε-λύ-κ-ετον.
3.	λε-λύ-κ-ατον.*	ἐ-λε-λυ-κ-έτην.
Plur. 1.	λε-λύ-κ-αμεν.	ἐ-λε-λύ-κ-εμεν.
2.	λε-λύ-κ-ατε.	ἐ-λε-λύ-κ-ετε.
3.	λε-λύ-κ-ᾶσι.	ἐ-λε-λύ-κ-εσαν.

	Second Perfect.	*Second Pluperfect.*
Sing. 1.	πέ-φην-α,† *I have appeared.*	ἐ-πε-φήν-η,‡ *I had appeared.*

Second Aorist.—Stem ε-λιπ-.

Sing. 1.	ἔ-λιπ-ον.	(*Like the Indicative Imperfect.*)
2.	ἔ-λιπ-ες, etc.	

SUBJUNCTIVE MOOD.

	Present.—Stem λυ-.	*First Aorist.*—Stem λυ-σ-.	
Sing. 1.	λύ-ω,* *I may loose*, etc.	λύ-σ-ω,* *I may loose*, etc.	
2.	λύ-ῃς.	λύ-σ-ῃς.	
3.	λύ-ῃ.	λυ-σ-	(*Like the Present Subjunctive.*)
Dual. 2.	λύ-ητον.	λυ-σ-	
3.	λύ-ητον.	λυ-σ-	
Plur. 1.	λύ-ωμεν.	λυ-σ-	
2.	λύ-ητε.	λυ-σ-	
3.	λύ-ωσι.	λυ-σ-	

	First Perfect.—Stem λε-λυ-κ.	
Sing. 1.	λε-λύ-κ-ω, *I may have loosed*, etc.	
2.	λε-λύ-κ-ῃς.	
3.	λε-λυ-κ-	(*Like the Present Subjunctive.*)
Dual. 2.	λε-λυ-κ-	
3.	λε-λυ-κ-	
Plur. 1.	λε-λυ-κ-	
2.	λε-λυ-κ-	
3.	λε-λυ-κ-	

Second Perfect.

πε-φήν-ω,† *I may have appeared.*

Second Aorist.—Stem λιπ-.

Sing. 1. λίπ-ω, *I may have left.*
2. λίπ-ῃς, etc.
(*Like the Present Subjunctive.*)

OPTATIVE MOOD.

	Present.—Stem λυ-.	*Future.*—Stem λυ-σ-.	
Sing. 1.	λύ-οιμι, *I might loose*, etc.	λύ-σ-οιμι, *I would loose*, etc.	
2.	λύ-οις.	λυ-σ-, etc.	
3.	λύ-οι.	λυ-σ-	(*Like the Present.*)
Dual. 2.	λύ-οιτον.	λυ-σ-	
3.	λυ-οίτην.	λυ-σ-	
Plur. 1.	λύ-οιμεν.	λυ-σ-	
2.	λύ-οιτε.	λυ-σ-	
3.	λύ-οιεν.	λυ-σ-	

	First Aorist.—Stem λυ-σ-.	*First Pluperfect.*—Stem λε-λυ-κ-.
Sing. 1.	λύ-σ-αιμι, *I might loose*, etc.	λε-λύ-κ-οιμι, *I might have loosed.*
2.	λύ-σ-αις or -ειας.	λε-λύ-κ-οις, etc.

† The flexions are the same as in the First Perfect.

‡ The flexions are the same as in the First Pluperfect.

Sing. 3.	λύ-σ-αι* or -ειε.	λε-λυ-κ-	(*Like the Optative Present.*)
Dual. 2.	λύ-σ-αιτον	λε-λυ-κ-	
3.	λυ-σ-αίτην.	λε-λυ-κ-	
Plur. 1.	λύ-σ-αιμεν.	λε-λυ-κ-	
2.	λύ-σ-αιτε.	λε-λυ-κ-	
3.	λύ-σ-αιεν or -ειαν.	λε-λυ-κ-	

Second Pluperfect.	*Second Aorist.*—Stem λιπ-.	
Sing. 1. πε-φήν-οιμι.	1. λίπ-οιμι	(*Like the Opt. Present*)
(*Like the 1st Pluperfect.*)	2. λίπ-οις	

IMPERATIVE MOOD.

	Present.—Stem λυ-.	*First Aorist.*—Stem λυ-σ-.
Sing. 2.	λῦ-ε, *loose thou*, etc.	λῦ-σ-ον,* *loose thou*, etc.
3.	λυ-έτω.	λυ σ-άτω.
Dual. 2.	λύ-ετον *	λύ-σ-ατον.
3.	λυ-έτων.	λυ-σ-άτων.
Plur. 2.	λύ-ετε.*	λύ-σ-ατε.
3.	λυ-έτωσαν or -όντων.	λυ-σ-άτωσαν or -άντων*

	First Perfect.—Stem λε-λυ-κ-.	*Second Perfect.*
Sing. 2.	λέ-λυ-κ-ε.*	πέ-φην-ε.*
3.	λε-λυ-κ-έτω.	(*Like the 1st Perfect*)
Dual. 2.	λε-λύ-κ-ετον	*Second Aorist.*—Stem ε-λιπ-.
3.	λε-λυ-κ-έτων.	
Plur. 2.	λε-λύ-κ-ετε.	*Sing.* 2. λίπ ε.
3.	λε-λυ-κ-έτωσαν or -όντων.	(*Like the Present Imperative.*)

INFINITIVE MOOD.

Present.	λύ-ειν, *to loose, to be loosing.*
Future.	λύ-σ-ειν, *to be about to loose.*
First Aorist.	λῦ-σ-αι, *to loose, to have loosed.*
First Perfect.	λε-λυ-κ-εναι, *to have loosed.*
Second Perfect.	πε-φη-ν-έ-ναι, *to have appeared.*
Second Aorist.	λιπ-εῖν, *to leave, to have left.*

PARTICIPLES.

Present	λύ-ων, *loosing.*
Future.	λύ-σ-ων, *about loosing.*
First Aorist.	λύ-σ-ας, *having loosed.*
First Perfect.	λε-κυ-κ-ώς, *having loosed.*
Second Perfect.	πε-φην-ώς, *having appeared.*
Second Aorist.	λιπ-ών, *having left.*

The connection of the parts will become obvious if we put the stems together.

STEMS.

Present.	*Imperfect.*	*Future.*	*First Aorist.*	*First Perfect.*
λυ-.	ἐλυ-.	λυσ-.	ἐλυσ-.	λελυκ-.

First Pluperfect.	*Second Perfect.*	*Second Pluperfect.*	*Second Aorist.*
ἐλελυκ-.	πεφην-.	ἐπεφην-.	ἐλιπ-.

The first thing which the student should do is to make himself familiar with the stems. Having got the stems, he will easily acquire the rest.

After he has learnt to recognise the connection and derivation of the several parts, and so formed some idea of the perfect simplicity of the whole, he should commit the entire paradigm to memory, and not pass on until he has accomplished the task. He will find that the effort will be more than compensated by the gain.

It is customary in Greek grammar to give four parts of the verb as the principal parts, or those parts from which the others may be formed—viz., the Present, the Future, the Perfect, and the Aorist. The connection of the other parts with these four is shown in the table of stems given above. This may be seen in the following examples—τίω, *I honour*; βουλεύω, *I advise*; and λούω, *I wash*:—

Present.	*Future.*	*Perfect.*	*Aorist.*
τίω.	τίσω.	τέ-τικα.	ἔτισα.
βουλεύω.	βουλεύσω.	βε-βούλευκα.	ἐβούλευσα.
λούω.	λούσω.	λέ-λουκα.	ἔλουσα.

Here we have the same parts in their stems:—

Pres. Stem.	*Future Stem*	*Perfect Stem.*	*Aorist Stem.*
τι-.	τισ-	τε-τικ-.	ἐ-τισ-.
βουλευ-.	βουλευσ-.	βε-βουλευκ-.	ἐ-βουλευσ-.
λου-.	λουσ-.	λε-λουκ-.	ἐ-λουσ-.

From these the other parts are readily formed. Take τισ- as an example.—

τισ-.

τίσ-ω, τίσ-οιμι, τίσ-ειν, τίσ-ων, ἔτισ-α. τίσ-αιμι, τῖσ-αι, τίσ-ας, etc.

What these parts are the student must learn from the paradigm.

He may be assisted in becoming acquainted with the verb in different ways. Let him, with that view, study this table of

THE PERSONAL TERMINATIONS OF THE ACTIVE VOICE.

	Singular.	*Dual.*	*Plural.*
	PRINCIPAL TENSES		
Ind. Pres. and Fut.	-ω, -εις, -ει.	-ετον, -ετον.	-ομεν, -ετε, -ουσι.
The Subj. all tenses	-ω, -ῃς, -ῃ.	-ητον, -ητον.	-ωμεν, -ητε, -ωσι.
Ind. Perf.	-α, -ας, -ε.	-ατον, -ατον.	-αμεν, -ατε, -ασι.
	HISTORIC TENSES.		
Ind. Imperf.	-ον, -ες, -ε.	-ετον, -ετην.	-ομεν, -ετε, -ον.
1st Aorist.	-α, -ας, -ε.	-ατον, -ατην.	-αμεν, -ατε, -αν.
Pluperfect.	-η, -ης, -ει.	-ετον, -ετην.	-εμεν, -ετε, -εσαν
Optative $^{o}_{a}$	-ιμι, -ις, -ι.	-ιτον, -ιτην.	-ιμεν, -ιτε, -ιεν.
	IMPERATIVE.		
Pres. and Perfect.	-ε, -ετω.	-ετον, -ετων.	-ετε, -ετωσαν.
Aorist.	-ον, -ατω.	-ατον, -ατων.	-ατε, -ατωσαν.

Observe certain characteristics, and see how they are preserved in their several forms. Thus *σ* is the characteristic of the future. Accordingly, *σ* is found in the future indicative, in the future subjunctive, in the future infinitive, and in the future participle. From the future the first aorist is immediately derived, and so the *σ* appears in its forms. In the first aorist forms, however, the *σ* is connected, not with *ο*, but with *α*, forming *σα*. This, then, may be considered as the characteristic of the first aorist; and this characteristic runs through all the forms of that tense. Thus, when the characteristic of a tense is known, it is easy to ascertain what part of the tense any particular form is, and how it stands connected with other parts of the same stem, as well as with other stems, and with the common root.

Several of the forms of the verb recur, and they are distinguished in the paradigm by an asterisk. Let the student collect these and compare them together, until he is familiar with them, assigning each to their several positions in the verb. Thus, *λύσω* is either the first person singular indicative future active, or it is the first person singular of the first aorist subjunctive. *Λυσαι* occurs twice, as (1) the third person singular optative first aorist active, and (2) the infinitive of the first aorist active. It will be seen again as (3) the second person singular imperative first aorist middle. (The student will carefully note that the accent distinguishes one of these forms from the others.)

As an exercise, the student should write out in full, in the active voice, the three verbs *τίω*, *βουλεύω*, and *λούω*, given above. Having written them carefully several times over from the copy, he should write them out from memory, beginning with one tense, then taking two tenses, then three tenses at a time, until he can accomplish the whole.

He may then write out the ensuing exercises, giving from memory the Greek forms required, and assigning, also from memory, the English significations.

EXERCISE 66.

Translate into English :—

1. **Λύων.** 2. **Λύσειν.** 3. **Λύει.** 4. **Λέλυκα.** 5. **Ἐλελύκη.** 6. **Λύσω.** 7. **Λυσοίτην.** 8. **Λύσοις.** 9. **Λυέτω.** 10. **Λύετε.** 11. **Ἔλυον.** 12. **Λύσει.** 13. **Λύομεν.** 14. **Ἐλυέτην.** 15. **Λύοιμι.** 16. **Ἔλυσα.** 17. **Λέλυκε.** 18. **Ἔλυσε.** 19. **Λύσαιμι.** 20. **Λῦσον.** 21. **Λυσάτων.** 22. **Λύσας.** 23. **Λελύκω.** 24. **Λέλυκας.** 25. **Ἐλελύκεσαν.** 26. **Ἔλυσαν.** 27. **Λελύκασι.** 28. **Λύσαιτε.** 29. **Λύσῃς.** 30. **Πέφηνας.** 31. **Ἔλιπες.** 32. **Λίπῃς.** 33. **Λίποις.** 34. **Λιπέτω.** 35. **Λιπών.** 36. **Πεφηνέναι.** 37. **Ἐπεφήνης.** 38. **Πεφήνοι.** 39. **Λύσειε.** 40. **Λύσειαν.**

EXERCISE 67.

Translate into Greek :—

1. I have appeared. 2. Ye two left. 3. He might leave. 4. Ye might leave. 5. They loose. 6. They may loose. 7. They might loose. 8. Ye might have loosed. 9. Loose thou. 10. Let them loose. 11. I have loosed. 12. Ye will loose. 13. They may have loosed. 14. He might have loosed. 15. To loose. 16. To be about to loose. 17. Being about to loose. 18. Having loosed. 19. He may loose. 20. They two had loosed. 21. Ye two might loose. 22. Ye two may loose. 23. They have appeared. 24. Ye two have appeared. 25. He has appeared.

KEY TO EXERCISES.

Ex. 64.—1. The file consisted of a hundred men. 2. The time was (lit. *it was of time*) a little before sunset. 3. The laws are the punishments of transgressors. 4. The punishment for these things (or *for these men*) is death. 5. Corn failed, and could not be purchased. 6. You may see the mountain. 7. The valour of Agesilaus was a pattern. 8. We have no breakfast. 9. I will be the convener. 10. This man is the victor. 11. I am one of these. 12. The king thinks that you are his (subjects). 13. The planting of trees, therefore, is part of (*belongs to*) the art of agriculture. 14. They have a market. 15. We were in extremities. 16. Cyrus was in this condition. 17. This will be in your power. 18. There is no little good in harmony. 19. To violence belong enmities and dangers. 20. I wish to be superior to my friends in (or *by*) care. 21. Agesilaus was present bringing gifts. 22. Ships had come (lit. *were present*) to Cyrus from the Peloponnesus.

Ex. 65.—1. Τοῦτο ἐπ' ἐμοί [ἐπὶ ἐμοὶ] ἐστιν. 2. Οἱ νόμοι ἐπὶ σοί εἰσιν. 3. Ἐπὶ σοί ἐστι σίτου πρίασθαι. 4. Ἐπὶ τοῖς πολεμίοις ἦν παρεῖναι. 5. Ἐπὶ παισὶν ἀγαθοῖς ἐστι περιεῖναι. 6. Ἐπ' ἐμοὶ ἔσται τῇ πολει προσεῖναι. 7. Αἱ ζημίαι τοῖς ἁμαρτωλοῖς πρόσεισιν. 8. Ἡ ἐπιμελεια σὴ τῶν φίλων πᾶσίν ἐστι παράδειγμα. 9. Αἱ νῆες τῷ βασιλεῖ προσεισιν.

ENGLISH LITERATURE.—V.

[*Continued from p.* 267.]

THE "CANTERBURY TALES" (*continued*).

Of the other portion of the poem, the tales themselves, we must speak but briefly. We have already pointed out the judgment with which Chaucer adapted the tale to the teller. The stories may be roughly divided into two classes—the dignified or pathetic tales related by the higher and more educated class of the pilgrims; and the broad, coarse, but humorous stories told by the travellers of lower rank. The first and longest of the tales of the first class is the Knight's tale, which contains the story of Palamon and Arcite, derived no doubt by Chaucer from Boccaccio. It is the story of Palamon and Arcite, a romance of love and chivalry, of which the characters and the scene belong to ancient Greece, while the manners are mainly those of mediævalism. The poem might stand by itself as a work of no inconsiderable length, since it consists of 2,250 verses. It is founded on the much longer production of Boccaccio, called the "Teseide," Theseus being one of the characters, and is the same story which has been told in the play of *The Two Noble Kinsmen*. The Squire's tale is suited to the character of the squire. It is a wild story of love and enchantment, probably of Oriental origin, and only half finished. The Man of Law's tale is the pathetic story of Constance, borrowed by Chaucer from the "Confessio Amantis" of Gower, as it had been by Gower from earlier writers. The Doctor of Physic tells the Roman story of Virginia. The Prioress relates the characteristic story of a little Christian child murdered by Jews, and of the miracles that followed his death and revealed the crime. The Clerk's tale, one of the most pathetic tales ever told, is the story of Patient Griselda, since made familiar in many forms to all readers, but then told in English for the first time, being the last tale in the "Decameron."

Among the stories of the second class, the most humorous perhaps are those of the Miller, the Prior, and the Canon's Yeoman; but the first and second of these, like most of Chaucer's humorous tales, are much too coarse to suit the taste of the present day, though their morality of thought and purpose is always pure and true. The Parson's tale is of a class by itself. It is in prose, and is, in fact, a sermon or moral discourse.

The following powerful description of the Temple of Mars and its decoration is taken from the Knight's tale:—

And downward on a hil under a bent,[1]
Ther stood the Tempul of Marz Armypotent,
Wrought al of burned steel of which thentre[2]
Was long and streyt, and gastly for to see.
And thereout came a rage and such a prise,[3]
That it made all the gates for to rise.
The northen light in at the dore schon,
For window on the walls ne was ther noon,
Thorugh the which men might no light discern.
The dores were alle ademauntz[4] eterne,
I-clenched overthwart and endelong[5]
With iren tough; and for to make it strong
Every piler the tempul to susteine
Was tonne greet, of iren bright and schene:[6]
Ther saugh I first the dark ymagining
Of felony, and al the compassyng;
The cruel ire, ees rad as eny gleede;[7]
The pikepurs,[8] and eek the pale drede;
The smyler with the knyf under his cloke;
The schipne brennyng[9] with the blake smoke;
The tresoun with the murtheryng in the bed;
The open werres, with woundes al bi-bled;[10]
Contek[11] with bloody knyf, and sharp manace;[12]
Al ful of chirkyng[13] was that sory place.
The slur of himself yet saugh I there,
His herte blood[14] hath bathed al his here;[15]
The nayl y-drove in the schode[16] a-nyght;
The colde deth, with mouth gapyng upright.
Amyddes of the tempul sat mischaunce,
With sory comfort and evel contenaunce
I saugh woodnes[17] laughyng in his rage:
Armed complaint, outhees,[18] and fiers outrage.
The carroigne[19] in the busshe, with throte y-corve;
A thousand slain, and not of qualme y-storve;[20]
The tiraunte, with the preye by force y-raft;
The town destroied, there was no thing laft.
Yet saugh I brente the schippes hoppesteres;[21]
The hunte[22] strangled with[23] the wild beres:
The sowe freten[24] the child right in the cradel;
The cooke i-scalded, for al his longe ladel.
Nought beth forgeten the infortune of Mart;
The carter over-ryden of his cart,
Under the whel ful lowe he lay adoun.
Ther wer also of Martz divisioun,[25]
The barbour,[26] and the bowcher, and the smyth,
That forgeth scharpe swerdes on his stith.
And all above depeynted in a tour
Saw I conquest sitting in gret honour,
With the scharpe sword over his heed
Hangynge by a sotil twyne threed.[27]

Chaucer's was a complete human nature—as complete as Shakespeare's, though with less of philosophical depth and stately enrichment. The poet of the "Canterbury Tales" has the simplicity of a child, combined with the knowledge of a man, Though a scholar and an accomplished writer, his treatment of the joys and sorrows of human life has in it something elemental and primitive; yet he could depict society like a courtier and a man of the world. Though his chief work was never completed, it remains a noble monument of the genius of a great Englishman who died more than a century and a half before the fulness of the Elizabethan age.

FROM THE DEATH OF CHAUCER TO THE ELIZABETHAN PERIOD.

With the death of Chaucer and his few eminent contemporaries the first period of English literature closes, and it is succeeded by a period of literary dearth. The last half of the fourteenth century was, as we have seen, in England, an age of national unity and national glory, of religious and intellectual energy. But, for the century which followed, England was torn by the civil conflicts arising out of the claims of the rival houses of York and Lancaster. The flower of her nobles fell in the field or on the scaffold; but the distresses of the nobles can have been but small in comparison with those of other classes. In respect of foreign policy, except during the short though brilliant interlude of Henry V.'s French wars, the power and influence of England sank very low. The religious movement, which seemed under Wiclif's leading to promise so much, appears to have shared the fate of all premature efforts. The severe persecution of the Lollards under the Lancastrian kings, the errors and excesses of their own leaders, and the preoccupation of men's minds with the stern realities of civil war, seem between them to have been wholly fatal to the reforming spirit which Wiclif had kindled; though subsequent events showed that there was more of his spirit left among the masses in England than might have been thought. Moreover, the slaughter and ruin of so many of the cultivated classes during the civil conflicts of course reduced the number of those for whom books would be written to far below what it had once been. From all these causes, the country between the death of Chaucer and the re-settlement of the English crown upon the family of Tudor, which we have taken as the second period of English literary history, was one extremely unfavourable to literature, and singularly barren of any valuable literary fruit. Indeed, though England produced many writers during this century, there is not one of them who, in almost any other age, would be thought worthy of mention. The best known among them are two poets, Occleve and Lydgate, the former a lawyer, and apparently a contemporary of, though very much younger than Chaucer: the latter a monk, who flourished a few years later, and who was a skilful versifier, though no poet.

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[1] A bend—that is, a slope.
[2] The entry. This contraction is very common in Chaucer.
[3] Press or crowd.
[4] Adamant.
[5] Across and along.
[6] Shining.
[7] Spark.
[8] Pickpurse, thief.
[9] Ships burning.
[10] Blod, covered with blood.
[11] Contention.
[12] Menace.
[13] Shrieking.
[14] Heart's blood.
[15] Hair.
[16] Driven into the hair—*i.e.*, into the head.
[17] Madness.
[18] Outcry.
[19] Carrion, corpse.
[20] Not dead of disease. To storve or starve is to die.
[21] "Schippes hoppesteres" is probably the dancing ships, from the motion of a ship on the waves.
[22] Hunter.
[23] *With* is frequently used for *by*.
[24] Devouring.
[25] Of the company, the army of Mars.
[26] The barber-surgeon.
[27] The reference is to the sword of Damocles.

Sir Thomas More (*After Holbein*)

Yet, with all its barrenness, one event makes the later years of the fifteenth century a great epoch in the history of our literature, and that is the introduction into England of the art of printing, which took place probably about the year 1474. This art had been used in Germany for twenty or thirty years previously; but the honour of its introduction into England is due to William Caxton, a learned and laborious scholar and author, who during a residence abroad acquired the art, which he imparted to his countrymen. Before the close of the century Caxton found many imitators, and printing-presses became numerous, not only in London, but in Oxford and several other cities.

In Scotland during the same period the literary spirit was far more active than in England. A national literature in Scotland had begun with Barbour, Archdeacon of Aberdeen, who flourished during the latter half of the fourteenth century, and was thus a contemporary of Chaucer. His principal work is a long poem in which he relates the adventures of Robert Bruce. The literature of which he may be said to have been the founder was as thoroughly national as that of England; and the language in which it was composed, though not identical with the literary language of England at the same period, was not less highly cultivated. It was the language of the Scottish Court, and of the educated classes in Scotland; and it bears much the same relation to the present Lowland Scotch dialect that the literary English of the same date does to the ordinary spoken language of to-day in England. The early Scottish writers themselves were careful to assert that they wrote Scotch, not English. Among the successors of Barbour during the fifteenth century the most celebrated are Wyntoun, the author of a metrical chronicle, principally of the history of Scotland; King James I. of Scotland, the romantic story of whose capture and captivity in England is so well known, and who wrote the "King's Quhair" in honour of the lady of whom he was enamoured; William

Dunbar, a poet of considerable power; Gawain Douglas, Bishop of Dunkeld, the first translator of Vergil's "Æneid" into any English dialect (for we may now venture to call his language English, though he would have been but little pleased to hear it so called); Robert Henryson, or Henderson; a poet known among his contemporaries as Blind Harry, or Harry the Minstrel, author of a narrative poem in honour of William Wallace; and the accomplished knight Sir David Lyndsay. It would be inconsistent with the plan of these elementary lessons to go into any elaborate examination of the works of these early Scottish writers; but it must by no means be overlooked by the student of English literature, and we have said enough to intimate its importance.

With the accession of Henry VII. to the throne of England, the second period into which we have divided the history of English literature ends. Not that any great revival of literary energy, or any great change in the condition of our literature, is to be seen upon this event; but England was at this time brought under new influences which in the end produced great results. So long as the country was wasted with civil war, or paralysed by universal distrust, any real progress in literature or learning was impossible. But with the close of the dynastic struggle the danger of civil war was at an end. Domestic peace and the influence of a strong government brought with them increasing wealth and prosperity. Men were at leisure for the pursuits of peace, and England was in a condition to take her place in the race for learning. In the fifteenth century the decisive test by which advancement in learning was to be measured was knowledge of the Greek language. Among many Continental nations, and especially in Italy, the Greek language and literature had been studied for the greater part of the century. But now for the first time we find Greek regularly taught, and a high degree of Greek scholarship attained in England. And this in its turn, while it was partly caused by, largely increased that close communication between English and foreign scholars which was necessary in order to give to England the full benefit of what had been achieved in other countries. All these causes contributed to prepare the national mind in England to receive its share of that great wave of intellectual energy which was beginning to sweep over Europe, and to render possible the literary glories of the sixteenth century.

THOMAS CRANMER.

The reign of Henry VII. itself has little literary fruit to show. Stephen Hawes was a poet once famous; but his many poems, of which the chief is an allegorical work, "The Pastime of Pleasure," are now almost forgotten. A little later in date than Hawes was another poet, Alexander Barclay, whose chief work is a translation from the German of Sebastian Brandt's satire, "The Ship of Fools."

John Skelton belongs to the reign of Henry VII. and the early part of the next. He was a churchman by profession, and his scholarship is spoken of by no less a scholar than Erasmus in terms of the highest admiration. He was a voluminous writer, both in Latin and English; but what he best deserves to be remembered for are his humorous and satiric poems in English. The great butt of his satire was Cardinal Wolsey; and no doubt the great popularity of these poems, and probably, too, the impunity of their author, were due to the universal unpopularity of the Cardinal. To a modern taste, these satires are wholly destitute of poetical power; but they are not without humour, though their chief characteristic, and no doubt at the time their chief merit, was their exhaustless fertility of abuse. The jingling metre in which Skelton wrote, and the plainness of his abuse, may be well understood from a single specimen of a very few lines. The contrast between Wolsey's pride and his low birth are delicately alluded to as follows:—

> But this mad Amalek,
> Like to a Mameluke,
> He regardeth lords
> No more the potshords;

He is in such elation
Of his exaltation,
And the supportation
Of our sovereign lord,
That, God to record,
He ruleth all at will
Without reason or skill;
Howbeit the primordial
Of his wretched original,
And his base progeny,
And his greasy genealogy,
He came of the sang royal
That was cast out of a butcher's stall.

In the reign of Henry VIII., we need hardly remind our readers, the Reformation was in progress. The great religious struggle was convulsing Europe, and England not less than other countries. The intellectual atmosphere was essentially religious and controversial, and the literature of the day is in the main of a corresponding character. Theological treatises, sermons, serious didactic and philosophic writing, form its staple.

One consequence of this character in the literature of the period deserves the careful attention of every student. It is an invariable law in the history of literature that the weapon is not forged till it is needed. No form of literary composition comes into existence till the time has come when men's thoughts require that form for their due expression. Up to the time at which we are speaking, any literature in English having anything artistic about it had been the literature of pleasure, and its form, therefore, was naturally almost exclusively poetical. There had, no doubt, been controversies enough carried on in England, as that between Nominalists and Realists, and others upon like questions of philosophy. But except for a short time in the days of Wiclif, controversy and speculation had till now been amongst philosophers, and on subjects which concerned them alone. They had, therefore, naturally been carried on in Latin, the language of the learned. But the questions now at issue were questions which concerned every man. The theologians and philosophers of the Reformation period had to address themselves not to the learned class, but to the nation; and they aimed not merely at compelling the assent of men's judgments, but at engaging their sympathies and rousing them to action. For this purpose they needed an instrument of a compass and variety unknown before. The formation of English prose style therefore dates from this period.

William Tyndale.

A very judicious critic, Hallam, pronounces Sir Thomas More to have been the first who wrote good English prose. More was unquestionably the first in learning, in genius, and in integrity among the Englishmen of his day. He was known and respected among scholars throughout all Europe; filled the highest offices in the State with equal uprightness and ability; and at last died on the scaffold for his fidelity to the Roman Catholic faith. Among his works, the one which is best known in the present day is his "Utopia," in which he develops his views of government and political systems by depicting an ideal republic. The "Utopia" was written in Latin, but More's English writings are numerous, most of them being tracts bearing upon various phases of the great controversies of the day. His English work of most permanent interest is "The Life and Reign of King Richard III."

Among the leaders of the English Reformation were many copious and fluent writers, Cranmer and Latimer perhaps standing first among them. Less serious in purpose, but of not less interest in the present day, are the translation by Lord Berners of the great Chronicle of Froissart, and the works of Roger Ascham. The learned Ascham was tutor to both Queen Elizabeth and Lady Jane Grey. He left behind him two works, "The Schoolmaster," a treatise on education, and "Toxophilus," the object of which is to explain and encourage the use of the bow.

But there can be no doubt that by far the most important prose works of the reigns of Henry VIII. and his successor—most important in the history of literature, no less than from other and higher points of view—were the several translations of the Bible into the English tongue, and the compilation of the Book of Common Prayer. It must be remembered that each of the long series of versions, beginning with that of Tyndale and Coverdale in Henry VIII.'s reign and ending with our present authorised version in James I.'s, was not a separate, independent translation, but, speaking generally, each was founded upon and largely influenced by its predecessor. And each of the various forms in which the Book of Common Prayer was from time to time issued was only a comparatively slight modification of the book previously in use. And if this be borne in mind, and it be further remembered how many thousands of men and women must in successive generations have derived all their literary enjoyment and formed their literary taste from little else than the English Bible and Prayer-Book, it will not be difficult to realise how great and lasting the influence even of the earliest translators and compilers must have been in developing the faculty of literary enjoyment, cultivating the national taste, and establishing and maintaining a high standard of tone and style in English prose-writing.

We have reserved to the close of this lesson the works of the two poets who adorned the latter portion of the reign of Henry VIII. The Earl of Surrey and Sir Thomas Wyatt were little removed in actual date from Barclay, Skelton, and others whom we have already mentioned, but in the style and character of their poetry there is the widest gulf between them: the one batch of poets connect the age of Henry VIII. with the darker period that preceded; the other are the harbingers of the Elizabethan day.

Sir Thomas Wyatt was the elder by some years of these illustrious friends, having been born in 1503, and died in 1542. From his wit and accomplishments he was one of the most brilliant ornaments of the Court of Henry VIII., and his public career was distinguished, but he died in the very prime of life. His character, as painted by Lord Surrey—and Lord Surrey's sketch is in harmony with all we learn of Wyatt from other sources—is singularly attractive.

Here are a few lines from Surrey's Elegy :—

A visage stern and mild ; where both did grow,
  Vice to contemn, in virtue to rejoice .
Amid great storms whom grace assured so,
  To live upright, and smile at Fortune's choice.

Lord Surrey was born about 1517. He was heir-apparent to the dukedom of Norfolk, and the leading representative of the ancient and noble house of Howard. His rare mental gifts and noble and generous character made him, during his short career, the very ideal of the chivalrous noble. At the very close of Henry VIII.'s reign Surrey, together with his father the Duke of Norfolk, was thrown into prison on a charge of treason. There does not seem to have been the slightest pretext for any such charge, and probably it is to be ascribed to the jealousy and ill-will of the reigning favourite, Hertford. Surrey was, however, found guilty after the mockery of a trial; and one of the last acts of the king's life—the last of his long series of crimes—was to order his execution.

The poetry of Wyatt and Surrey is very similar in its general character, though Surrey was decidedly the greater poet of the two. The poems of both are generally short, and for the most part on amatory subjects. They are clearly formed upon Italian models; and they show a smoothness and ease of versification, and a delicacy and refinement both of thought and expression, quite unknown to any poet since Chaucer. Surrey deserves to be remembered, also, as the first to introduce blank verse into England. This metre he derived, no doubt, from the Italian, and he used it in his translation of two books of the "Æneid" of Vergil.

A single specimen of one short poem of Surrey is all that our space allows us to give. It is a fair example of his style :—

Give place, ye lovers, here before
  That spent your boasts and brags in vain ;
My lady's beauty passeth more
  The best of yours, I dare well sayen,
Than doth the sun the candle light,
Or brightest day the darkest night.

And thereto hath a troth as just
  As had Penelope the fair ;
For what she saith ye may it trust,
  As it by writing sealéd were ;
And virtues hath she many mo'
Than I with pen have skill to show.

I could rehearse, if that I would,
  The whole effect of Nature's plaint,
When she had lost the perfect mould,
  The like to whom she could not paint ;
With wringing hands, how she did cry,
And what she said, I know it, aye.

I know she swore, with raging mind,
  Her kingdom only set apart,
There was no loss by law of kind
  That could have gone so near her heart ;
And this was chiefly all her pain,
"She could not make the like again."

Sith Nature thus gave her the praise,
  To be the chiefest work she wrought,
In faith, methink, some better ways
  On your behalf might well be sought,
Than to compare, as ye have done,
To match the candle with the sun.

FRENCH.—XXXVI.

(*Continued from p. 273.*)

READINGS IN FRENCH.

JACOPO.

ON aime à recueillir, comme un religieux souvenir, tout ce qui appartient à la vie des hommes illustres. À ce titre l'anecdote suivante ne sera pas sans intérêt, car vous connaissez tous son principal héros : Napoléon !

Par un beau jour d'été, deux jeunes enfants, un garçon et une petite fille, s'amusaient à courir dans un magnifique jardin d'Ajaccio en Corse. Tous les deux, armés d'un filet pour prendre des papillons, se livraient avec ardeur à la poursuite de ces jolis insectes.

C'étaient Napoléon, l'un des fils de Charles Bonaparte et de Lœtitia Ramolini, et la petite Élisa, sa sœur.

Les deux enfants se dirigèrent vers un bouquet de lilas situé à l'extrémité du jardin, qu'une simple haie séparait de la campagne. Presque au même instant, les deux filets se posèrent sur un branche où venait de s'arrêter un papillon ; mais celui-ci, faisant un ricochet, s'échappe, et, s'élevant en zigs-zags dans les airs, prend sa course par-delà la haie et s'élance dans la campagne.

"Ah ! Napoléon, qu'est-ce donc que tu viens de faire ?"

"Je viens de franchir un défilé pour gagner la bataille. Suis-moi."

Alors écartant les branches, prenant sa sœur par la main, il lui facilite le passage de l'autre côté du jardin. Libres alors, ils s'élancent à la poursuite du fugitif et ne tardent pas à se trouver en rase campagne. Tout à coup, Élisa pousse un cri ; dans son ardeur elle a heurté une petite paysanne qui portait au bras un panier rempli d'œufs ; elle l'a renversée avec son fardeau, et les œufs brisés gisent à terre.

"Sauvons-nous," dit tout bas Élisa à Napoléon : "cette petite ne nous connait pas ; retournons vite à la maison, maman n'en saura rien."

"Je ne me sauverai pas, moi," fit Napoléon : "je reste. Vois cette pauvre petite, comme elle se désole ; c'est nous qui sommes la cause du malheur qui lui est arrivé ; c'est nous qui devons le réparer."

Élisa, honteuse, rougit et baissa les yeux ; mais, comme elle avait bon cœur, elle s'approcha de la petite, qui continuait à pleurer ; elle essuya ses larmes, et se mit à ramasser les œufs qui n'avaient point souffert ; hélas ! plus des deux tiers étaient cassés.

"Hélas !" disait la petite en sanglotant, "que devenir ? en voilà au moins pour un petit écu de perdus ! Que dire à maman quand je vais être de retour ? Je vais être battue, et le produit de ces œufs qui devait faire vivre notre famille pendant trois jours !"

"Allons ! calme-toi," dit Napoléon, en lui donnant deux petites pièces de monnaie qu'il avait dans sa poche ; "voilà déjà une partie du prix de tes œufs ; suis-nous pour le reste." Élisa s'approcha et lui dit mystérieusement à l'oreille :

"À quoi penses-tu donc, Napoléon ? Nous allons être au moins pour trois jours au pain sec et à l'eau."

"Nous avons cassé les œufs," répliqua Napoléon, "il faut les payer."

En ce moment on entendit la voix perçante de la bonne qui faisait retentir l'air des noms de Napoléon et d'Élisa.

"Nous voici ! nous voici !" répondirent ensemble les deux enfants.

"Ah ! c'est bien heureux ! depuis deux heures que je vous cherche. Quelle est donc cette petite ?" ajouta la bonne en voyant la paysanne qui marchait derrière Napoléon.

"C'est nous," dit Napoléon, "qui avons cassé ses œufs en courant aprés les papillons ; et je mène cette petite à maman pour qu'elle paie le dégât que nous avons fait."

Peu d'instants après, la bonne et les deux enfants, suivis de la petite paysanne, entrèrent dans une salle où était réunie la famille Bonaparte. Madame Lœtitia prit la parole :

"Napoléon, Élisa, je vous avais fait cadeau d'un filet ; mais vous m'avez désobéi en franchissant la haie et en courant plus loin à travers la campagne ; rendez-moi vos filets, cela vous épargnera l'occasion de me désobéir encore."

"Maman," fit Napoléon, "c'est moi qui suis coupable ; c'est moi qui ai entraîné Élisa."

La petite fille ne dit mot, mais elle sauta au cou de son frère.

"Ma sœur," dit l'archidiacre d'Ajaccio, "péché avoué est à moitié pardonné : je demande grâce pour Napoléon."

"Oh bien ! mon oncle," dit Élisa, "demandez grâce aussi pour moi, je vous en prie, car j'ai fait bien plus de mal que lui."

"Et quel si gros péché as-tu donc commis ?" dit le vieillard vénérable en souriant ; "parle franchement, et je te promets d'intercéder pour toi."

Élisa, un peu rassurée par la promesse de son oncle, commença, d'une voix tremblante, son récit. Elle raconta comment elle avait renversé la petite paysanne, et comment ses œufs avaient été brisés.

"Allons ! c'est très-bien, Élisa, tu as été franche ; comme ce n'est pas trop ton habitude, je veux t'en récompenser en me chargeant de solliciter aussi ta mère en ta faveur."

"Maman," dit alors Napoléon, "j'ai encore un grâce à vous demander. Vous me donnez dix sous par semaine pour mes menus plaisirs. Eh bien! achevez de payer les œufs de cette pauvre petite qui attend là ce que tout cela va devenir, et vous ne me donnerez plus rien jusqu'à ce que nous soyons quittes."

"D'accord," dit Madame Lœtitia en faisant approcher la petite paysanne, et lui donnant un petit écu. "Napoléon, en voilà pour six semaines."

L'enfant courut à Napoléon, et voulut lui remettre les deux pièces de monnaie qu'elle avait reçues de lui au moment où l'accident était arrivé; mais il refusa.

Cette probité plut à Madame Bonaparte, qui alors interrogea la petite paysanne. Elle apprit que c'était la fille d'un pauvre pêcheur, que sa mère était malade, qu'elle demeurait dans une chétive cabane, sur le bord de la mer, à quelque distance de l'endroit où son panier avait été renversé.

"Ta mère est malade, dis-tu, mon enfant? elle n'a pas de médecin qui la soigne, sans doute. J'irai la voir."

"Oh! maman, je vous en prie," s'écria Napoléon, "allons-y tout de suite. Nous reconduirons Charlotte."

"Volontiers," répondit Madame Bonaparte. "Allons, mes enfants, partons."

Les enfants ne se le firent pas répéter. Quelques instants après, ils arrivèrent au pied d'un rocher.

"C'est là," dit Charlotte, en désignant une misérable cabane.

Lorsqu'ils entrèrent, un jeune garçon de douze ans était occupé à faire un filet; une toute petite fille était assise à terre et mangeait une croûte de pain; une enfant beaucoup plus jeune encore, dormait dans un berceau cassé, couvert d'une vieille courtepointe presque en lambeaux.

La cabane contenait à peine quelques meubles indispensables. L'enfant endormi, quoique ses joues fussent pâles et ses bras maigres, était bien rangé dans sa couchette. Sur un mauvais grabat, était étendue, malade et souffrante, une femme jeune encore, mais dont les traits flétris faisaient peine à voir. La misère de ces pauvres gens toucha profondément le cœur de Madame Bonaparte; rien de pareil encore ne s'était offert à ses regards.

"Vous êtes malade, ma bonne femme," dit Madame Lœtitia en s'approchant; "un médecin vous donne-t-il des soins?"

"Ah! Madame, de pauvres gens comme nous ne doivent pas réclamer des soins qu'ils ne peuvent payer."

Pendant ce dialogue, Napoléon s'était approché de l'enfant qui faisait du filet, et n'avait pas tardé à faire avec lui plus ample connaissance.

Depuis ce temps, la cabane était souvent le but des promenades de Madame Lœtitia et de ses enfants.

Jacopo, tel est le nom du fils du pêcheur, s'était surtout concilié les bonnes grâces de Napoléon, qui, sur ses menus plaisirs, trouvait toujours le moyen de mettre quelque chose de côté pour lui. Aussi était-il devenu pour Jacopo l'objet d'une sorte de culte et d'adoration; pour Napoléon, Jacopo aurait tout sacrifié, jusqu'à sa vie.

Cependant, lorsque Napoléon eut atteint l'âge de dix ans, il dut quitter Ajaccio. Avant de partir, l'enfant alla faire ses adieux à la famille du pêcheur, et ce ne fut pas sans verser quelques larmes qu'il se sépara de Jacopo. Il avait une très-jolie boîte en ébène, de la grandeur à peu près d'une tabatière, à laquelle il tenait beaucoup; il y grava son nom avec la pointe d'un canif, et en fit cadeau à Jacopo, qui la reçut en sanglotant, et la plaça immédiatement sur son cœur. Jamais ce souvenir ne devait le quitter.

Nous ne suivrons point Napoléon dans les différentes phases de sa prodigieuse fortune.

Le deux décembre mil huit cent cinq, l'armée française était campée dans les plaines d'Austerlitz. Le soleil se lève; entouré de ses maréchaux, l'Empereur attend, pour donner ses ordres, que l'horizon soit tout à fait éclairci.

"Soldats," s'écria-t-il, "il faut finir cette campagne par un coup de tonnerre!" Et le combat s'engage aux cris de *Vive l'Empereur!*

Au plus fort de la mêlée un Russe parvient à quelques pas de Napoléon; il l'ajuste, le coup part; mais un soldat s'est précipité devant l'Empereur. Il tombe frappé de la balle qui devait atteindre le grand capitaine. Napoléon a tout vu; il donne l'ordre d'enlever le soldat et de le porter aux ambulances. Après la bataille, il courut s'informer lui-même de ce qu'il était devenu. Le soldat n'était que blessé. Lorsque l'Empereur parut, il sembla avoir oublié sa blessure; il leva sur lui des yeux brillant d'un éclat extraordinaire. Napoléon l'examine plus attentivement; un souvenir confus lui rappelle les traits de cet homme. Tout à coup il remarque dans la main du soldat les débris d'une boite d'ébène que la balle, en le frappant, a fracassée. Nul doute, c'est Jacopo! c'est le fils du pêcheur. C'était lui, en effet, lui qui n'avait osé, jusqu'à ce jour, pénétrer jusqu'auprès de celui qui, enfant, avait été son bienfaiteur; lui qui, ayant pris du service dans l'armée française, avait au moins voulu combattre pour ce Napoléon qu'il aimait tant. Toujours il portait sur son cœur la boite que Napoléon lui avait donnée; c'est elle qui avait amorti le coup du soldat russe; c'est elle qui lui avait sauvé la vie. Napoléon, comme vous le pensez bien, n'en resta pas là avec Jacopo. Il le plaça dans sa garde et pourvut à son avancement. Ses bienfaits s'étendirent sur toute la famille, et le nom de l'Empereur fut béni.

Plus tard nous retrouverons encore Jacopo. Quand la fortune se lassa enfin des faveurs qu'elle avait accumulées sur la tête du conquérant, que, précipité du haut de son trône, elle l'eut jeté sur le rocher de Sainte-Hélène, une barque cotoya longtemps les rivages de cette île, tandis qu'un vaisseau stationnait en pleine mer à quelque distance. C'était Jacopo qui avait résolu de délivrer le prisonnier. Tous ses efforts échouèrent contre la surveillance des Anglais. Désespéré, Jacopo alla s'établir à Sainte-Hélène; il parvint à obtenir l'autorisation de servir l'illustre captif. Il assista à son agonie, à sa mort, et jusqu'en 1840, il n'a pas quitté son tombeau. Lorsque enfin est arrivée l'éclatante réparation faite aux mânes du grand homme, Jacopo a pu accompagner ses cendres; il faisait partie du cortège. Aujourd'hui, vous pouvez voir dans la chapelle des Invalides un vieillard qui, chaque jour, vient s'agenouiller au pied du tombeau qui contient les dépouilles mortelles de l'Empereur. C'est Jacopo.

KEY TO TRANSLATION FROM FRENCH

MLLE. DE LAJOLAIS.

The gallery which the Emperor was to cross to go to the council was a large and long one, lighted by parallel windows, some looking out on the entrance court, the others on to the gardens. Nine o'clock had just struck, and little by little the two sides of this gallery were filled with people—with the curious, with petitioners, with officers on duty, with attendants of the household. Among all these people two women made themselves noticeable, the first by her beauty and the graceful air with which she acknowledged the respectful bows of all those who passed near her; and the other by her extreme youth, by the pallor which gave an extraordinary character to her beauty, and by her beautiful fair hair falling in numerous curls over her shoulders.

"Come, cheer up!" said the first to the second; "cheer up."

"I will not leave you," said the first one again. Then to give more weight to her words, her hand sought the hand of the young girl, and pressed it lovingly.

The most expressive, the saddest look responded to this kindness, and directly after the beautiful eyes of the child turned again towards the door by which the Emperor was to appear.

All her soul, young, loving, enthusiastic, seemed to have passed into her eyes; all the rest of her body appeared inanimate.

Two hours passed thus; two hours of waiting, of trouble, of anguish, and during these two hours neither of these children had moved. The younger, keeping her eyes fixed on this closed door, waited for it to open, to breathe, even to live; the other did not move her eyes beyond her companion. The most profound silence reigned in the gallery; you only heard the breathing, more or less distressed, of every one who was also waiting. At last eleven o'clock struck, the two sides of the door opened, and an usher announced the Emperor.

Several people appeared at the same time.

"Which?" asked Maria, in the deepest anxiety.

"The only one who has his hat on his head," quickly answered Hortense.

The young girl listened no longer; only seeing one being in all this crowd which was surrounding him, she leaves the ranks, throws herself at the feet of him they pointed out to her, crying out "Pardon! pardon!" and joins her hands with force, raising them towards heaven.

At these cries, at this unforeseen act, the Emperor stops, knitting his eyebrows.

"Again?" cries he, in an impatient tone. "I have said, too, that I do not want any more of such scenes!"

And crossing his arms on his breast, he wished to go on.

"Sire!" cried the young girl, to whom the position of her father gave an energy beyond her age, "I beseech you, listen to me! In the name of your mother, sire, listen to me! In the name of your father, grant to me the pardon of mine! He is my father, sire; he has probably been drawn away, misled; pardon him! Oh! sire, you hold the life of my father, and my own life in your hands. Have pity on an unhappy child who asks you for the life of her father. Sire! sire! forgiveness, pity, pardon."

"Leave me, mademoiselle," said the Emperor, pushing her with some abruptness.

But, without allowing herself to be intimidated (so precious a life was at stake), Mlle. de Lajolais, dragging herself along the marble floor of the gallery, cried with anguish—

"Oh! pity, pity, sire!—pardon! for my father! Oh! cast at least a look on me, sire!"

There was something so heartrending in this child's voice life of her father, that the Emperor stopped in spite of himself, and looked at her who implored him so earnestly.

Mlle. de Lajolais was very pretty, but at this moment her beauty resembled that of an angel. White as a swan, grief gave to her features a character energetic and impassioned; her beautiful fair hair streamed over her shoulders; her little hands, dried up by fever, had unconsciously seized one of the Emperor's hands, and had conveyed to him their burning heat. Kneeling down, her face bathed in tears, raising her large blue eyes towards him, on whom she seemed to wait for life or death, she could no longer speak, nor cry, nor breathe.

"Are you not Mlle. de Lajolais?" the Emperor asked her.

Without answering, Maria pressed the Emperor's hand more tightly.

He replied with severity, "Do you know that this is the second time that your father has made himself guilty of a crime towards the State, mademoiselle?"

"I know it," answered Mlle. de Lajolais, with the greatest ingenuousness, "but the first time he was innocent, sire."

"But this time he is not so," replied Bonaparte.

"But it is his pardon I ask of you, sire," replied Maria; "pardon, or I shall die before you."

The Emperor, unable longer to master his emotion, leant towards her, saying—

"Well! yes, mademoiselle, yes; I grant it to you. But rise——"

And smiling with encouragement and with kindness, he disengaged his hands, held all the time so tightly, and went away quickly.

The outbreak of joy was more dangerous for Mlle. de Lajolais than grief. The poor child fell heavily and senseless on the marble of the gallery. Thanks to the care of the Empress, of Princess Hortense, and of their ladies, Mlle. de Lajolais soon recovered consciousness. "My father, my father!" she murmured as soon as she could speak. "Oh! let me be the first to tell him of his pardon;" and rising, she wished to

escape from the arms which held her; but, too weak for such extremes of emotion, she fell back again into them without strength.

"There is no hurry now, mademoiselle," said one of the ladies; "take a little rest and food; you will go an hour later."

"An hour later!" cried out Maria; "you wish that I should delay for an hour the news of life to a man condemned to death, especially when this man is my father. Oh! madame!" she added, turning towards the Empress, "let me set out, I beseech you; just think, it is my father: that he has his pardon, and that he does not yet know it."

"Be it so, my child," answered the excellent Josephine; "but you cannot go alone to his prison."

"But I came alone to your castle," she answered hastily.

"Will your Majesty permit us to accompany Mlle. de Lajolais?" several officers and aides-de-camp of the Emperor asked at the same time, whom the action of Mlle. de Lajolais, although very natural, had filled with admiration.

"M. de Lavalette will do this service for me," said the Empress, smiling graciously at one of them; "as well as monsieur" (pointing to an aide-de-camp on duty). "You will use one of my carriages; go, gentlemen; I entrust Mlle. de Lajolais to you."

Although exhausted with fatigue, with want, and with emotion, Maria refused to take food and rest. She wished to see the horses harnessed herself, to hurry the people, and did not rest until she and her escorts were settled on the cushions of the carriage.

Then the carriage started at a gallop with six good horses; it got over the distance which separated Saint-Cloud from the prison with an incredible speed. During all the journey Maria, erect and rigid, kept her eyes fixed on the road which she had still to traverse; her gaze seemed to wish to devour the distance; her chest panted, as it were she, instead of the horses, who was drawing the carriage; and she was pale, so pale that two or three times her companions addressed a remark to her; but of no use, she did not hear them.

When the carriage stopped, she threw herself on to the footpath before M. de Lavalette had had time to offer her his hand to help her to get out, and only able to articulate this word, "Quick, quick!"

She rushed through the long corridors of the prison, preceding the jailer and her guides, and still repeating, "Quick, quick!" Arrived at the door of the cell, she was obliged to wait that the jailer might open its lock, and draw two enormous bolts; but scarcely had the door been opened than, throwing herself inside, she fell into the arms of her father, crying, "Papa, the Emperor . . . . life . . . . pardon." . . . She could not finish, her voice was lost in prolonged cries, each word begun, finished by a sob.

General de Lajolais thought for a moment that they had come to take him to lead him to his death, and that his daughter, having eluded the vigilance of the guards, had braved all to bid him adieu.

But M. de Lavalette soon undeceived him; seeing that Maria, overcome by her emotion, could not utter a sound, he took up her words:

"The Emperor grants to you your pardon, general," said he to him, "and you owe it to the courage and tenderness of your daughter."

Then with emotion, which he could not overcome, he told General de Lajolais all that his daughter had done for him.

E. MARCO DE SAINT-HILAIRE.

JACOPO.

One likes to collect, as a sacred relic, everything which relates to the lives of celebrated men. Under this head the following anecdote will not be without interest, for you all know its principal hero—Napoleon.

On a fine summer's day, two little children, a boy and a girl, were amusing themselves by running about in a magnificent garden at Ajaccio in Corsica. Both of them, armed with butterfly nets, threw themselves with ardour into the pursuit of these pretty insects.

These were Napoleon, one of the sons of Charles Bonaparte and of Lœtitia Ramolini, and his sister, little Eliza.

The two children turned towards a clump of lilac, situated at the end of the garden, which was separated from the country by a simple hedge. Nearly at the same moment the two nets were lowered on a branch on which a butterfly had just stopped; but the latter, making a bound, escapes, and rising in zigzags into the air, takes its course beyond the hedge and flies away into the country.

"Oh! Napoleon, what are you going to do now?"

"I am going to clear a pass to win the battle. So follow me."

Then pulling aside the branches, taking his sister by the hand, he makes the way easy for her from the other side of the garden. Free then, they rushed off in pursuit of the fugitive, and did not slacken until they found themselves in the open country. All at once Eliza utters a cry; in her eagerness she has knocked against a little peasant girl, who was carrying on her arm a basket full of eggs; she has thrown her over with her burden, and the broken eggs lie on the ground.

"Let us run away," Eliza said in a low voice to Napoleon: "this little girl does not know us; let us go home quickly. Mamma will know nothing about it."

"I will not run away," said Napoleon; "I shall stay here. Look how this poor little child is grieving; it is we who are the cause of the misfortune that has happened to her; it is we who ought to make it right."

Eliza, ashamed, blushed and dropped her eyes; but as she was kind-hearted, she went up to the little girl who was still crying; she wiped her tears and began to pick up those eggs which had not suffered. Alas! more than two-thirds of them were broken.

"Alas!" said the little girl, sobbing, "what will become of me? here are at least half-a-crown's worth lost! What can I say to my mother when I go home? I shall be beaten, and the value of these eggs ought to have been a living for our family for three days!"

"Come! cheer up," said Napoleon, giving her two small pieces of money which he had in his pocket; "here is already a part of the price of your eggs; follow us for the rest." Eliza came up and whispered mysteriously to him—

"What do you think, Napoleon? We shall be put on bread and water for at least three days."

"We have broken the eggs," answered Napoleon, "we must pay for them."

At that moment they heard the piercing voice of the nurse, who was making the air resound with the names of Napoleon and Eliza.

"Here we are, here we are!" the two children answered together.

"Ah! that is very fortunate! I have been looking for you for two hours. Whoever is this little girl?" added the nurse on seeing the peasant girl who was walking behind Napoleon.

"We have broken her eggs in chasing butterflies," said Napoleon; "and I am taking this little girl to mamma, so that she may pay for the damage that we have done."

A few moments after, the nurse and the two children, followed by the little peasant girl, went into a room in which the Bonaparte family was gathered. Madame Lœtitia said to them—

"Napoleon, Eliza, I have made you a present of a net; but you have disobeyed me in getting through this hedge, and in running about in the country; give me back your nets—that will save you the opportunity of disobeying me again."

"Mamma," said Napoleon, "it is I who am the guilty one, it is I who led Eliza."

The little girl did not say a word, but she threw her arms round her brother's neck.

"My sister," said the Archdeacon of Ajaccio, "a sin confessed is half pardoned: I ask forgiveness for Napoleon."

"Well, uncle," said Eliza, "ask pardon for me also, I beg you; for I have done much more harm than he."

"And what great sin have you committed?" said the venerable old man, smiling; "speak frankly, and I promise to intercede for you."

Eliza, a little reassured by her uncle's promise, began her story in a trembling voice. She related how she had upset the little peasant girl, and how her eggs had been broken.

"Come, that is very well, Eliza, you have been frank; as that is not any too much your custom, I wish to reward you for it in taking upon myself to beg your mother in your favour also."

"Mamma," then said Napoleon, "I have still another favour to ask of you. You give me ten sous a week for my pocket-money: well! finish paying for the eggs of that poor little girl, who is waiting [to see] for what will be the result of all this, and you need give me nothing more until we are quits."

"Agreed," said Madame Lœtitia, making the little peasant girl go up to her, and giving her three francs [half a French crown]. "Napoleon, there is [your money] for six weeks."

The child ran to Napoleon, and wished to give him back the two coins she had received from him when the accident had happened; but he refused.

This honesty pleased Madame Bonaparte, who then questioned the little peasant girl. She learnt that she was the daughter of a poor fisherman, that her mother was ill, that she lived in a miserable hut by the seaside, at some distance from the place where her basket had been overturned.

"Your mother is ill, you say, my child? Probably she has no doctor to attend to her. I will go and see her."

"Oh! mamma, I beg you," cried Napoleon, "go there directly. We will take Charlotte back."

"Willingly," replied Madame Bonaparte. "Come, my children, let us start."

The children did not wait for a repetition of this. Some moments after they arrived at the foot of a rock.

"There it is," said Charlotte, pointing out a wretched hut.

When they entered, a boy of twelve years old was occupied in making a net; quite a little girl was seated on the ground and was eating a crust of bread; a child, much younger still, was sleeping in a broken cradle, covered with an old counterpane almost in rags.

The hut only contained a few indispensable pieces of furniture. The sleeping child, although its cheeks were pale and its arms thin, was neatly arranged in its little bed. On a poor pallet was lying, ill and suffering, a woman still young, whose withered features were a pain to see. The misery of these poor people deeply touched Madame Bonaparte's heart. She had never looked upon anything like it before.

"You are ill, my good woman," said Madame Lœtitia, approaching her; "have you a doctor caring for you?'

"Ah! madame, poor people like we ought not to claim care for which they cannot pay."

During this dialogue Napoleon had approached the child who was making the net, and had not been slow in making great friends with him.

From this time the hut was often the end of the walks of Madame Lœtitia and her children.

Jacopo—for such was the name of the fisherboy—had especially won the good graces of Napoleon, who, from his pocket-money, always found the means of putting something aside for him. And he had become the object of a kind of worship and adoration for Jacopo; for Napoleon, Jacopo would have sacrificed everything, even his life.

However, when Napoleon had reached the age of ten years, he was obliged to leave Ajaccio. Before leaving, the child went to say good-bye to the fisherman's family, and it was not without shedding a few tears that he parted from Jacopo. He had a very pretty ebony box, just about the size of a snuff-box, which he valued much; he engraved his name on it with the point of a knife, and made a present of it to Jacopo, who received it, sobbing, and placed it immediately on his heart.

This souvenir was never to leave him.

We will not follow Napoleon through the different phases of his marvellous fortune.

On the 2nd of December, 1805, the French army was encamped on the plains of Austerlitz. The sun was rising; surrounded by his marshals, the Emperor was waiting to give his orders until the horizon was quite clear.

"Soldiers," cried he, "we must finish this campaign by a stroke of thunder!" And the fight engages with cries of "Long live the Emperor!"

In the thickest of the fight a Russian arrives within a few paces of Napoleon; he takes aim at him, the charge goes off, but a soldier throws himself down before the Emperor. He falls, struck with the ball which ought to have reached the great captain. Napoleon has seen everything; he gives the order to raise the soldier, and to bear him to the ambulances. After the battle he hastened to get information himself of what had become of him. The soldier was only wounded. When the Emperor appeared, he seemed to have forgotten his wound; he raised to him his eyes, shining with an extraordinary brightness. Napoleon looked at him most attentively; a confused memory recalled the man's features to him. All at once he noticed in the soldier's hand the remains of an ebony box, which the bullet in striking had shattered. There is no doubt, he is Jacopo! the son of the fisherman. It is he, indeed, he who had not dared until this day to go near him who as a child had been his benefactor; he who, having enlisted in the French army, had at least wished to fight for this Napoleon whom he loved so much. Always he carried on his heart the box which Napoleon had given to him; it was that which had deadened the charge of the Russian soldier, it was that which had saved his life. Napoleon, as you may well think, did not confine his gratitude to this with Jacopo. He placed him in his guard, and provided for his advancement. These benefits were extended to all the family, and the name of the Emperor was blessed.

Later on we shall still find Jacopo. When fortune, tired at length of the favours which she had heaped on the head of the conqueror, when, hurled from the height of his throne, she had thrown him on the rock of St. Helena, a bark coasted along the banks of this island for a long time, whilst a vessel was stationed in the open sea at some distance. This was Jacopo, who had resolved to liberate the prisoner. All his efforts were frustrated by the vigilance of the English. In despair, Jacopo went and lived at St. Helena; he succeeded in obtaining permission to wait on the illustrious captive. He was present at his last illness, at his death, and up to 1840 he had not left his grave. When at last the brilliant reparation made to the remains of the great man came to pass, Jacopo was able to accompany his ashes; he made a part of the procession. To-day you can see in the Chapelle des Invalides an old man, who every day comes to kneel at the foot of the tomb which contains the mortal remains of the Emperor. This is Jacopo.

ELECTRICITY.—XV.

[*Continued from p.* 317.]

PRACTICAL APPLICATIONS OF THERMO-ELECTRICITY.

For practical purposes it matters little from what place or places the E.M.F. is derived in a thermo-electric couple; it is sufficient to know that the application of heat to one junction generates a certain E.M.F. in the circuit, the amount of which we can determine when we know the difference of temperature between the heated junction and the remainder of the circuit. For a single couple consisting of any but the very rare metals the E.M.F. that can be obtained, even with a large difference of temperature, is extremely small when compared with that given by most Voltaic cells, and to this cause alone must be attributed the fact that thermo-electric batteries have not come into general use as generators of electricity for commercial purposes. Every other item appears to be in their favour when compared with Voltaic batteries or dynamos; they contain no liquids, nor do they require the renewal of any materials like batteries, they contain no moving parts, require no attention, nor are they liable to break down like dynamos; they have fairly small resistances, and when once fixed in position, it is only necessary to light a jet of gas, or some such heating source, in order to start and maintain them working, whilst their E.M.F.s can be easily controlled by raising or lowering the heating flame. As a question of economy, the cost of zinc in the primary battery, which is the substance usually consumed, renders it a most expensive generator when compared with the modern dynamo as driven by the steam engine; and yet the combination of the dynamo and steam engine is in itself a most wasteful method of transforming the energy stored up in the coal into the energy of the electric current. The thermo-electric couple effects this transformation without the intervention of the steam engine, which is the principal source of loss, and therefore should do it in a much more economical manner; at the same time, however, further improvement might easily be made in this direction. These are immense advantages, but, notwithstanding them all, the low E.M.F. has so far proved itself to be an insurmountable obstacle to their economical use on a commercial scale as current-generators.

As in the case of Voltaic cells a number of thermo-electric couples can be joined up in series, and thus form a thermo-electric battery whose E.M.F. is the sum of the separate E.M.F.s of the couples of which it is built up. Such an arrangement is shown in Fig. 78, which is a battery consisting of four couples in series, and connected to a galvanometer which is capable of measuring volts. If the ends marked 1, 3, 5, 7, and 9 are maintained at the temperature of the atmosphere, and the ends marked 2, 4, 6, and 8 are all heated to the same temperature, and if one terminal of the galvanometer is permanently joined to 1 whilst the other is joined successively to the ends 3, 5, 7, and 9, the following indications on the galvanometer will be obtained:—A certain E.M.F. will be indicated when the end is joined to 3, twice that E.M.F. when it is joined to 5, three times that E.M.F. when it is joined to 7, and four times when joined to 9, thus showing that a thermo-electric battery can be built up having any desired E.M.F., provided a sufficient number of couples are arranged in series. The internal resistance of the battery, of course, increases with the addition of each couple, the total resistance being the sum of the resistances of the separate couples.

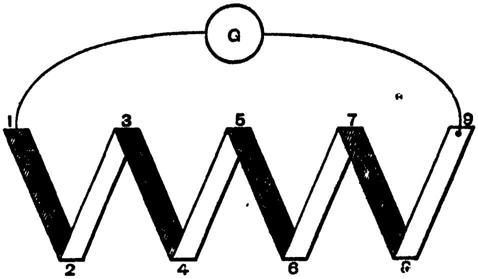

Fig. 78.—Thermo-Electric Battery.

The first really useful thermo-electric battery was constructed by Melloni, who called it a *Thermo-pile*, Fig. 79, and that name, or the Melloni Pile, is still used for his particular type. The metals used consist of bismuth and antimony, each metal being square and substantial in section. These metals are laid alternately side by side so as to build up a cube, and each piece is carefully insulated from its neighbours by a layer of gypsum or some such substance. The alternate ends are then soldered together, so as to convert the whole into a battery containing as many couples as there are pieces of bismuth or antimony in the cube. Four sides of the cube are then covered with an insulated brass case, leaving the soldered junctions exposed as shown, and a pair of insulated terminals, *x* and *y*, are fixed, one to the last bismuth of the series, and the other to the last antimony. All the even junctions are thus exposed at one open face of the cube, and all the odd ones at the opposite face—the arrangement is theoretically similar to that shown in Fig. 78. As a current-generator the Melloni Pile is an extremely expensive and very inefficient piece of apparatus, but it was never intended for this purpose; it was intended for measuring small differences of temperature, and for this purpose it is invaluable. The smallest difference of temperature between one face of the cube and the opposite one gives rise to a measurable E M F. in the pile. Owing to the large section of the metals composing the pile its resistance is extremely small, and for that reason it should be used in connection with a galvanometer of very small resistance. The best effect will be obtained when using a galvanometer whose resistance is equal to that of the pile. The pile is usually protected by square caps, *n* and *m*, Fig. 80, placed over their ends, and by a funnel-shaped piece of brass blackened on the inside, so as to preserve the junctions from heat radiated by surrounding objects. The combination of the pile and galvanometer is the most delicate means we have of measuring small differences of temperature. A difference of temperature of ·0002° Cent. can be measured by it, and the heat radiated by the fixed stars can be detected. Such differences cannot be detected by any other form of thermometer which has yet been devised.

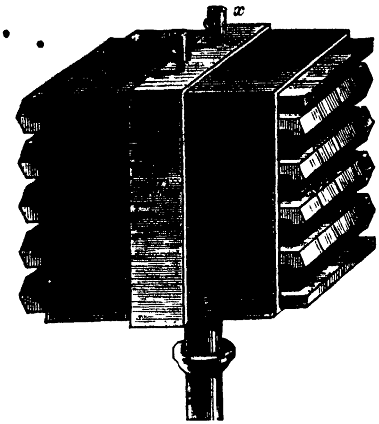

Fig. 79.—MELLONI'S THERMO-PILE.

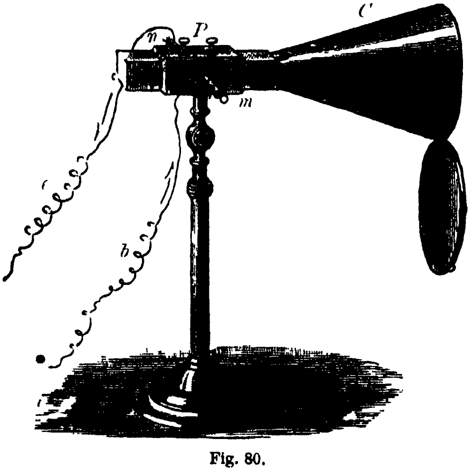

Fig. 80.

Instead of using pure bismuth and antimony the following alloys might with advantage be substituted:—

For the thermo-positive element,

Bismuth	10 parts	by weight.
Antimony	1 ,,	,,

For the thermo-negative element,

Antimony	15 parts	by weight.
Cadmium	7 ,,	,,

As a current-generator intended for use on a commercial scale one of the most successful thermo-electric batteries is that due to Clamond, and illustrated in Fig. 81. This battery contains 50 couples joined up in series; the couples are arranged in rings of ten, and five of these rings are shown placed one above the other. The details of construction can be best seen in Fig. 82, which shows the plan of one of these rings. The thermo-positive elements consist of an alloy of bismuth and antimony; they are the solid substantial blocks marked A, and are arranged in a circle. The thermo-negative elements consist of sheet-iron, and are marked F in the figure. The junctions to be heated are made on the interior portions of the

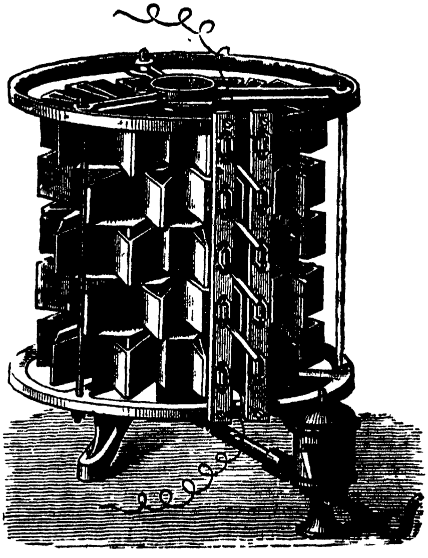

Fig 81.—CLAMOND'S THERMO-BATTERY.

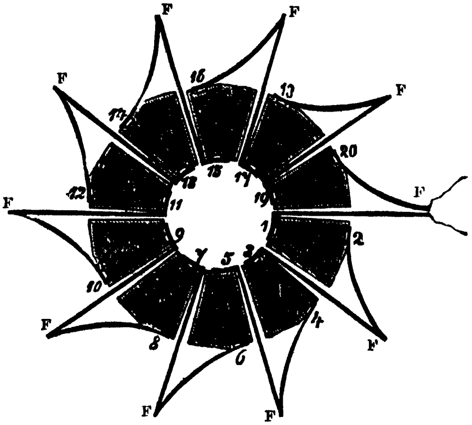

Fig. 82

blocks, and are marked 1, 3, 5, 7, 9, 11, 13, 15, 17, and 19, whilst the junctions to be cooled are made on the exterior portions of the blocks, and are marked 2, 4, 6, 8, 10, 12, 14, 16, 18, and 20. The inner junctions are packed round with asbestos cement, and in the circular space which is shown an earthenware tube containing a number of small holes is fixed vertically. Ordinary gas is passed into this tube, and the jets, when lighted, heat the inner junctions, 1 to 19, to the desired temperature. The projecting pieces of sheet-iron marked F present a large radiating surface, and thus help to keep the exterior junctions moderately cool. In Fig 81 five of these rings are fixed, and are insulated from each other, but are all joined up in series by means of the clamps shown in the front of the figure. By means of these clamps the rings can be joined up in series or in parallel as desired. The E.M.F. of each couple when the gas is full on is about ·05 volt, and its internal resistance about ·005 ohm; so that when the rings are all joined in series

The E.M.F. of battery = 2·5 volts.
Internal resistance of battery = ·25 ohm.

With rings connected in parallel

E.M.F. = ·5 volt.
Internal resistance = ·01 ohm.

The battery consumes about 6 cubic feet of gas per hour.

Though the E.M.F. is small for such a large number of couples, it must not be forgotten that the internal resistance is also small, and though for general work it cannot be said to be economical, still there are many situations in which it might be used with advantage. The facts that it is only necessary to light a jet of gas in order to start the battery working, that there are no acids used, that none of the parts ever require renewing, and that it will work continuously for an indefinite period of time, are factors which cannot be overlooked in estimating the efficiency of the working. No Voltaic battery can work continuously for a long period of time, but the thermo-electric battery works best in this manner. When used for intermittent work, its life is shortened, owing to the unequal expansion and contraction to which it is subjected by the heating and cooling. For sending a current through a high external resistance it is seldom an efficient generator, but through a low resistance, as, for instance, through a small electroplating bath, it may be both efficient and convenient.

An improved form of the Clamond battery, due to Du Moncel, is illustrated in Fig. 83, and is intended for work on a large scale. The composition of the elements is the same as in the one previously described, but their arrangement is somewhat different. The rings are built up over a coke furnace, and the heated gases have to pass up through the central tube T, down the flue O, and up through P, before escaping at A. The external vertically-arranged sheets D are of copper, and help to radiate heat from the cool junctions. The battery contains 6,000 elements joined up in series. It is about 8 feet in height, and 3 feet 3 inches in diameter. It has an E.M.F. of about 220 volts when in full working order, and a resistance of about 30 ohms. Its consumption of coke is at the rate of about 2 cwt. per hour. This battery is capable of running

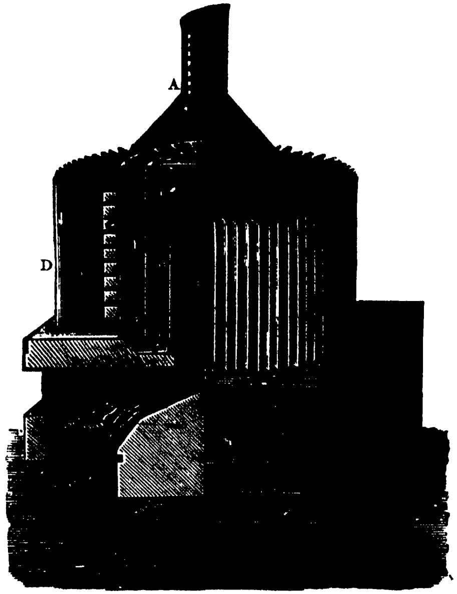

Fig. 83.—Du Moncel's Improved Clamond Battery.

a couple of arc lights, but it is not efficient, only about 5 per cent. of the energy in the coke being converted into energy in the form of current, whilst 95 per cent. of the heat is wasted.

A certain amount of success has been achieved by Rebicek's modification of Noë's battery. The thermo-positive element is an alloy of zinc and antimony, and the negative one is German-silver. The battery contains 25 couples in series, arranged radially round a common axis where a single Bunsen gas-burner is placed. One set of junctions are thus placed on the inside and the alternate ones on the outside of the battery. The single Bunsen flame is sufficient to heat the junctions arranged on the inside, whilst those on the outside are well situated for radiating heat. When the flame is full on, the E.M.F. of the battery is about 2·5 volts and the resistance about ·75 ohm. Two or three of these batteries are convenient for electro-plating on a small scale.

The battery of Markus attracted considerable attention when first brought out, though it has not realised the expectations that were formed about it. Both elements are alloys, having the following compositions :—

Thermo-positive element,

Antimony - - -	12 parts.
Zinc - - - - -	5 ,,
Bismuth - - -	1 ,,

Thermo-negative element,

Copper - - - -	10 parts.
Zinc - - - - -	6 ,,
Nickel - - - -	6 ,,

One set of junctions are fastened to an iron bar, but insulated from it by mica, and the other set are immersed in water. Heat is communicated to the alternate junctions from the iron bar. The E.M.F. of each couple is about ·05 volt, and the resistance is a variable quantity, owing to the fact that the elements easily oxidise at the contacts and increase the resistance.

When it is considered what enormous strides have been made in almost every branch of electrical engineering within the past few years, it is singular to note how small is the development that has taken place in thermo-electricity during the same time. The immediate cause is due to the fact that no two of the commoner metals lie sufficiently far apart on the thermo-electric scale to give a fairly high E.M.F. within ordinary ranges of temperature, whilst those that would give a reasonable E.M.F. are too rare. A pair of alloys, however, might be found which would give a high E.M.F. combined with reasonable cost, and it is in this direction that we must look for further development of the thermo-electric battery.

ALGEBRA.—XVIII.

[*Continued from p. 286.*]

APPLICATION OF ALGEBRA TO GEOMETRY.

291. It is often expedient to make use of algebraical notation for expressing the relations of geometrical quantities, and to throw the several steps of a demonstration into the form of equations. By this, the nature of the reasoning is not altered; it is only translated into a different *language*. *Signs* are substituted for *words*, but they are intended to convey the same meaning. A great part of the demonstrations in Geometry really consist of a series of equations, though they may not be presented to us under the algebraic forms. Thus the proposition that *the sum of the three angles of a triangle is equal to two right angles*, may be demonstrated either in common language or by means of the signs used in algebra.

Let the side AB of the triangle ABC (Fig. 1) be produced to D; let the line BE be drawn parallel to AC; and let GHI be a right angle.

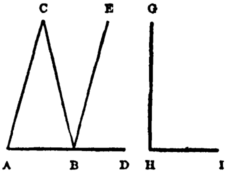

Fig. 1.

The demonstration in words is as follows:—

(1) The angle EBD is *equal* to the angle BAC. (Euclid I. 29).
(2) The angle CBE is *equal* to the angle ACB.
(3) Therefore, the angle EBD *added* to CBE—that is, the angle CBD—is *equal* to BAC *added* to ACB.
(4) If to these equals we add the angle ABC, the angle CBD *added* to ABC is *equal* to BAC *added* to ACB and ABC.
(5) But CBD *added* to ABC is *equal* to twice GHI—that is, to two right angles. (Euclid I. 13.)
(6) Therefore, the angles BAC and ACB and ABC are together *equal* to twice GHI, or two right angles.

Now by substituting the sign $+$ for the word *added* or *and*, and the sign $=$ for the word *equal*, we shall have the same demonstration in the following form :—

(1) By Euclid I. 29, $EBD = BAC$.
(2) And $CBE = ACB$. (Euclid I. 29.)
(3) Adding the two equations, $EBD + CBE = BAC + ACB$.
(4) Adding ABC to both sides, $CBD + ABC = BAC + ACB + ABC$.
(5) But by Euclid I. 13, $CBD + ABC = 2\,GHI$.
(6) Therefore, $BAC + ACB + ABC = 2\,GHI$.

By comparing, one by one, the steps of these two demonstrations, it will be seen that they are precisely the same, except that they are differently expressed.

It will be observed that the notation in the example just given differs in one respect from that which is generally used in algebra. Each quantity is represented, not by a *single letter*, but by *several*. In common algebra, when one letter stands immediately before another, as ab, without any character between them, they are to be considered as *multiplied* together.

But in Geometry, A B is an expression for a *single line*, and not for the product of A into B. Multiplication is denoted either by a point or by the sign ×. The product of A B into C D is A B.C D, or A B × C D.

There is no impropriety, however, in representing a geometrical quantity by a single letter. We may make b stand for a line or an angle, as well as for a number.

If, in the example above, we put the angle

$\mathrm{EBD} = a$, $\mathrm{ACB} = d$, $\mathrm{ABC} = h$,
$\mathrm{BAC} = b$, $\mathrm{CBD} = g$, $\mathrm{GHI} = l$,
$\mathrm{CBE} = c$,

the demonstration will stand thus:—

(1) By Euclid I. 29, $a = b$.
(2) And $c = d$.
(3) Adding the two equations, $a + c = g = b + d$.
(4) Adding h to both sides, $g + h = b + d + h$.
(5) By Euclid I. 13, $g + h = 2l$.
(6) Therefore, $b + d + h = 2l$.

This notation is apparently more simple than the other; but it deprives us of what is of great importance in geometrical demonstrations—a continual and easy reference to the figure. To distinguish the two methods, *capitals* are generally used for that which is peculiar to Geometry; and *small letters* for that which is properly algebraic.

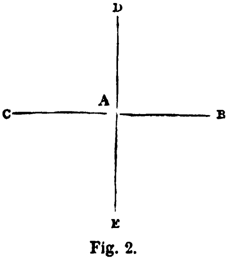

Fig. 2.

If a line, whose length is measured from a given point or line, be considered *positive*, a line proceeding in the *opposite* direction must be considered *negative*. If A B (Fig. 2), reckoned from D E on the *right*, is positive, A C on the *left* is negative. Hence, if in the course of a calculation the algebraical value of a line is found to be *negative*, it must be measured in a direction opposite to that which, in the same process, has been considered positive.

In algebraical calculations there is frequent occasion for *multiplication*, *division*, *involution*, etc. But how, it may be asked, can *geometrical* quantities be multiplied into each other? One of the factors in multiplication is always to be considered as a *number*. The operation consists in repeating the multiplicand as many times as there are *units* in the multiplier. How, then, can a *line*, a *surface*, or a *solid*, become a multiplier?

To explain this it will be necessary to observe that whenever one geometrical quantity is multiplied into another, some *particular length* is to be considered *the unit*. It is immaterial what this length is, provided it remains the same in different parts of the same calculation. It may be an inch, a foot, a rod, or a mile. If, for instance, one of the lines be a foot long, and the other half a foot, the factors will be, one 12 inches, and the other 6, and the product will be 72 inches. Though it would be absurd to say that one line is to be repeated *as often as another is long*, yet there is no impropriety in saying that one is to be repeated as many times as there are feet or rods in the other. This the nature of a calculation often requires.

If the line which is to be the multiplier is only a *part* of the length taken for the unit, the product is a like part of the multiplicand. Thus, if one of the factors is 6 inches, and the other half an inch, the product is 3 inches.

Instead of referring to the measures in common use—as inches, feet, etc.—it is often convenient to fix upon one of the lines in a figure as the unit with which to compare all the others. When there are a number of lines drawn within and about a *circle*, the *radius* is commonly taken for the unit. This is particularly the case in trigonometrical calculations.

The observations which have been made concerning lines may be applied to *surfaces* and *solids*. There may be occasion to multiply the *area* of a figure by the number of inches in some given line.

But here another difficulty presents itself. The product of two lines is often spoken of as being equal to a *surface*: and the product of a line and a surface as equal to a *solid*. But if a line has no *breadth*, how can the multiplication—that is, the *repetition*—of a line produce a surface? And if a surface has no thickness, how can a repetition of it produce a solid?

In answering these inquiries it must be admitted that measures of length do not belong to the same class of magnitudes with superficial or solid measures, and that none of the steps of a calculation can, properly speaking, transform the one into the other. But though a line cannot become a surface or a solid, yet the several measuring units in common use are so adapted to each other that squares, cubes, etc., are bounded by lines of the same name. Thus the side of a square inch is a linear inch; that of a square rod, a linear rod, etc. The *length* of a linear inch is, therefore, the same as the length or breadth of a square inch.

If, then, several square inches are placed together, as from Q to R (Fig. 3), the *number* of them in the parallelogram O R is the same as the number of linear inches in the side Q R; and if we know the length of this, we have, of course, the area of the parallelogram, which is here supposed to be one inch wide.

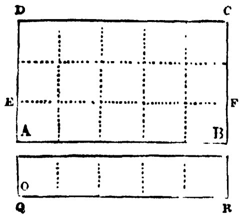

Fig. 3.

But if the breadth is several inches, the larger parallelogram contains as many smaller ones, each an inch wide, as there are inches in the whole breadth. Thus, if the parallelogram A C (Fig. 3) is 5 inches long and 3 inches broad, it may be divided into three such parallelograms as O R. To obtain, then, the number of squares in the large parallelogram, we have only to multiply the number of squares in one of the small parallelograms into the number of such parallelograms contained in the whole figure. But the number of square inches in one of the small parallelograms is equal to the number of linear inches in the *length* A B. And the number of small parallelograms is equal to the number of linear inches in the *breadth* B C. It is, therefore, said concisely that *the area of a parallelogram is equal to its length multiplied into its breadth.*

We hence obtain a convenient algebraical expression for the area of a right-angled parallelogram. If two of the sides perpendicular to each other are A B and B C, the expression for the area is $AB \times BC$; that is, putting a for the area,

$$a = AB \times BC.$$

It must be remarked, however, that when A B stands for a *line*, it contains only *linear* measuring units; but when it enters into the expression for the *area*, it is supposed to contain *superficial* units of the same name.

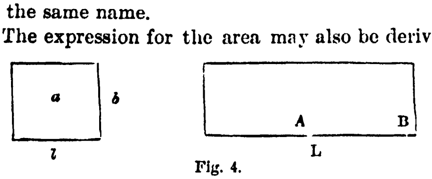

Fig. 4.

The expression for the area may also be derived by another method more simple, but less satisfactory perhaps to some. Let a (Fig. 4) represent a square inch, foot, rod, or other measuring unit, and let b and l be two of its sides; also, let A be the area of any right-angled parallelogram, B its breadth, and L its length. Then it is evident that, if the breadth of each were the same, the areas would be as the lengths; and if the length of each were the same, the areas would be as the breadths.

That is, $A : a :: L : l$, when the breadth is given;
And $A : a :: B : b$, when the length is given;
Therefore, $A : a :: B \times L : b \times l$, when both vary.

That is, the area is as the *product* of the *length* and *breadth*.

Hence, in solving problems in Geometry, the term *product* is frequently substituted for *rectangle*; and whatever is there proved concerning the equality of certain rectangles, may be applied to the product of the lines which contain the rectangles.

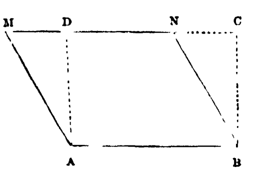

Fig. 5.

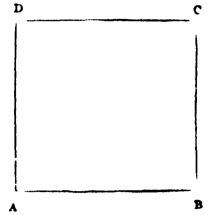

Fig. 6.

The area of an *oblique* parallelogram is also obtained by multiplying the base into the perpendicular height. Thus the expression for the area of the parallelogram A B N M (Fig. 5) is $MN \times AD$, or $AB \times BC$. For $AB \times BC$ is the area of the right-angled parallelogram A B C D; and by Euclid I. 36, parallelograms upon equal bases and between the same parallels, are equal; that is, A B C D is equal to A B N M.

The area of a *square* is obtained by multiplying one of the sides *into itself*. Thus the expression for the area of the square A C (Fig. 6) is $(AB)^2$; that is, $a = (AB)^2$.

For the area is equal to $AB \times BC$.

But $AB = BC$; therefore, $AB \times BC = AB \times AB = (AB)^2$.

The area of a *triangle* is equal to *half* the product of the base and height. Thus the area of the triangle A B G (Fig. 7) is equal to half A B into G H, or its equal B C; that is,

$$a = \tfrac{1}{2} AB \times BC, \text{ or } \tfrac{1}{2} AB \times GH.$$

For the area of the parallelogram A B C D is $AB \times BC$; and by Euclid I. 41, if a parallelogram and a triangle are upon the same base and between the same parallels, the triangle is half the parallelogram.

Hence, an algebraical expression may be obtained for the area of any figure whatever which is bounded by right lines. For every such figure may be divided into triangles.

Thus, the right-lined figure ABCDE (Fig. 8) is composed of the triangles ABC, ACE, and ECD.

The area of the triangle $ABC = \frac{1}{2}AC \times BL$;
That of the triangle $ACE = \frac{1}{2}AC \times EH$;
That of the triangle $ECD = \frac{1}{2}EC \times DG$.

The area of the whole figure is, therefore, equal to

$$(\tfrac{1}{2}AC \times BL) + (\tfrac{1}{2}AC \times EH) + (\tfrac{1}{2}EC \times DG).$$

The expression for the *superficies* has here been derived from that of a *line* or *lines*. It is frequently necessary to *reverse* this order; to find a *side* of a figure from knowing its *area*.

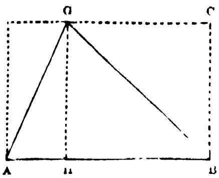

Fig. 7.

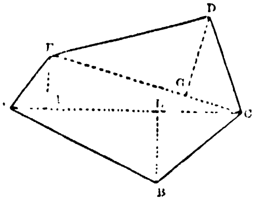

Fig. 8.

If the number of square inches in the parallelogram ABCD (Fig. 3), whose breadth, BC, is 3 inches, be divided by 3, the quotient will be a parallelogram, ABEF, *one* inch wide, and of the same length with the larger one. But the length of the small parallelogram is the length of its side, AB. The number of *square* inches in one is the same as the number of *linear* inches in the other. If, therefore, the area of the large parallelogram be represented by a, the side $AB = \frac{a}{BC}$; that is, *the length of a parallelogram is found by dividing the area by the breadth;* and $BC = \frac{a}{AB}$.

If a be put for the area of a *square* whose side is AB,

Then $a = (AB)^2$;
And extracting both sides, $\sqrt{a} = AB$.

That is, *the side of the square is found by extracting the square root of the number of measuring units in its area.*

If AB be the base of a *triangle*, and BC its perpendicular height,

Then $a = \frac{1}{2}BC \times AB$, or $\frac{1}{2}AB \times BC$;

And dividing by $\frac{1}{2}BC$, $\frac{a}{\frac{1}{2}BC} = AB$, and $BC = \frac{a}{\frac{1}{2}AB}$.

That is, *the base of a triangle is found by dividing the area by half the height, and the height by dividing the area by half the base.*

As a *surface* is expressed by the product of its length and breadth, the contents of a *solid* may be expressed by the product of its length, breadth, and depth. It is necessary to bear in mind that the measuring unit of solids is a *cube;* and that the side of a cubic inch is a square inch; the side of a cubic foot, a square foot, etc.

Let ABCD (Fig. 3) represent the base of a parallelopiped, five inches long, three inches broad, and *one* inch deep. It is evident there must be as many *cubic* inches in the solid as there are *square* inches in its base. And as the product of the *lines* AB and BC gives the area of this base, it gives, of course, the contents of the solid. But suppose that the depth of the parallelopiped, instead of being *one* inch, is *four* inches, its contents must be four times as great. If, then, the length be AB, the breadth BC, and the depth CO, the expression for the solid contents will be $AB \times BC \times CO$.

By means of algebraical notation, a geometrical demonstration may often be rendered much more simple and concise than in ordinary language. The proposition (Euclid II. 4), that when a straight line is divided into two parts, the square of the whole line is equal to the squares of the two parts, together with twice the product of the parts, is demonstrated by squaring a binomial.

Let the side of a square be represented by s;
And let it be divided into two parts, a and b.
By the supposition, $s = a + b$;
And squaring both sides, $s^2 = a^2 + 2ab + b^2$.

That is, s^2, the square of the whole line, is equal to a^2 and b^2, the squares of the two parts, together with $2ab$, twice the product of the parts.

Algebraical notation may also be applied with great advantage to the solution of geometrical *problems*. In doing this it will be necessary, in the first place, to form an algebraical equation from the geometrical relations of the quantities given and required; and then, by the usual reductions, to find the value of the unknown quantity in this equation.

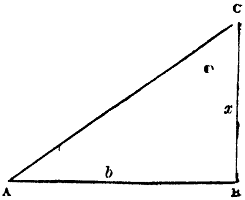

Fig. 9.

EXAMPLES.

1. Given b the base, and a the sum of the hypothenuse and perpendicular of the right-angled triangle ABC (Fig. 9), to find the perpendicular BC.

Let $x =$ the perpendicular BC. The sum of hypothenuse and perpendicular, $x + AC = a$. Then transposing x, $AC = a - x$.

(1) By Euclid I. 47, $(BC)^2 + (AB)^2 = (AC)^2$,

(2) That is, by the notation, $x^2 + b^2 = (a - x)^2$
$= a^2 - 2ax + x^2$.

And $x = \frac{a^2 - b^2}{2a} =$ B C, the side required.

Hence,

In a right-angled triangle, the perpendicular is equal to the square of the sum of the hypothenuse and perpendicular, diminished by the square of the base, and divided by twice the sum of the hypothenuse and perpendicular.

It is applied to particular cases by substituting *numbers* for the letters a and b. Thus, if the base is 8 feet, and the sum of the hypothenuse and perpendicular 16, the expression $\frac{a^2 - b^2}{2a}$ becomes $\frac{16^2 - 8^2}{2 \times 16} = 6$, the perpendicular; and this subtracted from 16, the sum of the hypothenuse and perpendicular, leaves 10, the length of the hypothenuse.

2. Given the base of a right-angled triangle A B C (Fig. 10) $= b$, and the difference between the hypothenuse and perpendicular $= d$, to find the perpendicular B C. Apply this where $b = 20$ and $d = 10$.

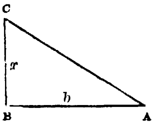

Fig. 10.

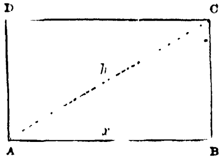

Fig. 11.

Let B C, the perpendicular, $= x$; then A C, the hypothenuse, $= x + d$. Now, by Euclid I. 47, $(\text{A C})^2 = (\text{A B})^2 + (\text{B C})^2$; and by substitution, $(x + d)^2 = b^2 + x^2$, or $x^2 + 2dx + d^2 = b^2 + x^2$.

$\therefore x = \frac{b^2 - d^2}{2d} = \frac{400 - 100}{20} = 15 =$ B C.

Exercise 76.

1. If the hypothenuse of a right-angled triangle A B C (Fig. 10) is h feet, and the difference of the other two sides d feet, what are the lengths of A B and B C? Apply this when $d = 2$, and $h = 10$.

2. If the hypothenuse (Fig. 10) is 20 rods, and the base is to the perpendicular as 3 to 4, find their lengths.

3. Having the perimeter of a parallelogram A B C D $= 2p$, and the diagonal $= d$, to find the length (l) and the breadth (b). Apply this when $d = 15$, and $2p = 42$ (Fig. 11).

4. The area of a right-angled triangle A B C (Fig. 12) is d square feet, and the sides D E, D F of the inscribed parallelogram are respectively b and a feet. Find B C.

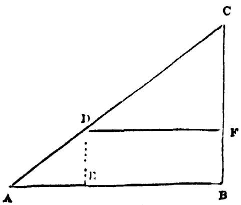

Fig. 12.

5. The perimeter of a right-angled triangle is s feet, and its area is a square feet. Find the hypothenuse.

6. Having the area of a parallelogram D E F G (Fig. 14) inscribed in a given triangle A B C $=$ C square feet, find D G. Draw C I perpendicular to A B; by supposition D G is parallel to A B. Let C I $= a$, A B $= b$, and D G $= x$; then C H $= \frac{ax}{b}$, I H $= a - \frac{ax}{b}$, etc.

7. The three sides of a right-angled triangle A B C (Fig. 13) are as follows: A C $= 10$, B C $= 6$, and A B $= 8$; find the segments C D and D A made by a perpendicular from B on A C.

8. Through a given point (P) in the diameter A B of the circle A Q B R (Fig. 15) to draw a right line so that its two parts, P R and P Q, shall have a given difference (d), if A P $= a$ and B P $= b$.

9. The height of an arch is 6 feet, and its span 20 feet; what radius was it struck with?

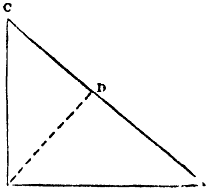

Fig. 13.

10. Find the side of that square whose area is $2\frac{1}{4}$ times its perimeter.

11. Find the side of that cube whose solid content and surface are expressed by the same number.

12. The area of a *right-angled* triangle is 54 square feet, and its sides are in arithmetical progression; find their lengths. Also give a general solution when the area $= a$.

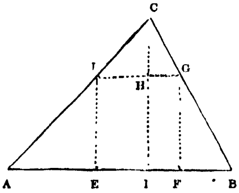

Fig. 14.

13. A rectangle contains 98 square feet, and the difference between the adjacent sides is 7 feet; find the sides.

14. The perimeter of a *right-angled isosceles* triangle is m feet; find the sides.

15. The difference between the perimeter and perpendicular of an *equilateral* triangle is m feet; find the length of one of its sides.

16. One side of a *right-angled* triangle is 15, and the excess of twice the other side above the hypothenuse is 33; find the side and hypothenuse.

17. The sides of a *right-angled* triangle are in geometrical progression—its area is m square feet; find the side which is a mean between the other two.

18. Given the difference between the diagonal and side of a square $= d$ feet, to find its area a; apply this when $d = 9{\cdot}9411255$.

19. If a right-angled triangle has its sides in arithmetical progression, they may be found by multiplying the square root of $\frac{1}{6}$ of the area by 3, 4, and 5 respectively; required the demonstration.

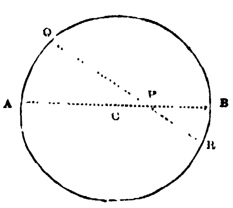

Fig. 15.

20. Given the area (a) and base (b) of a triangle A B C, to divide it into two equal parts by a line (F G) drawn parallel to the base (A B); find the length of F G, and its perpendicular, C E.

KEY TO EXERCISES.

Exercise 73.

1. $\frac{1}{11}, \frac{1}{12}, \frac{1}{13}, \frac{1}{14} \ldots \frac{1}{20}$. 2. $\frac{4}{11}, \frac{3}{7}, \frac{4}{17}$. 3. No answer required.

Exercise 74.

1. $a + 2$.	3. $a - 2b$.	5. $1 - 2b + y$.
2. $a + b$.	4. $2a - 3b + 4h$.	6. $a^5 - a^3 + a$.

7. $a^2 + 2b - 2$.
8. $x^2 - 2x + 1$.
9. $x^2 - 2x + 1$.
10. $2x^2 - x + 3$.
11. $2a - 3x$.
12 $x + 1$.
13. $a - b$.

EXERCISE 75.

1. 3 solutions. $x = 7, 4, 1$; $y = 1, 2, 3$; $z = 1, 2, 3$.
2. 1 solution. $x = 1$, $y = 2$, $z = 3$.
3. 1 solution. $x = 3$, $y = 2$, $z = 1$, and $m = 4$.
4. 10 solutions. $x = 1, 1, 1$, etc.; $y = 1, 2, 3$, etc., to 8; $z = 24, 21, 18$, etc., to 3; $n = 37, 38, 39$, etc., to 44; $x = 4, 4$; $y = 1, 2$; $z = 5, 2$; $n = 45, 46$.
5. 1 solution. 19 at £5, 1 at £1, 80 at 1s.
6. 301.
7. 7 solutions. Retired: 1*m* to 6, 2*m* to 7, 3*m* to 8, etc. Got up: 6*m* to 1, 7*m* to 2, 8*m* to 3, etc.
8. £6 13s.
9. $x = 39$.
10. 2 solutions. 1081 and 510, 299 and 1292.
11. $\frac{3}{7}$ and $\frac{3}{11}$.
12. 10 solutions. $x = 1, 3, 4, 6, 9, 13, 19, 27, 34$, and 69; $y = 69, 34, 27, 19, 13, 9, 6, 4, 3, 1$.
13. 6, 11, and 13.
14. 780 and 4110, 2778 and 2112, 4776 and 114.
15. 2 cwt. 5 lb, or 5 bshs. 34 lb.
16. 255 or 65535.

APPLIED MECHANICS—VII.

[*Continued from p.* 282.]

POWER, OR RATE OF DOING WORK — UNIT OF POWER — WATT'S EXPERIMENT — POWER OF WATERFALLS — POWER OF ENGINES, ETC.— NUMERICAL EXAMPLES.

WE have explained to you what is meant by mechanical work or energy, and we have given you examples of the way in which work is measured. We wish now to introduce to your notice a new quantity, and, since it is a measurable quantity, we must also introduce you to its unit. The quantity is called POWER. You will have noticed that in some books this term is used rather loosely, being often applied to the *force* which produces motion or raises a load by means of a machine. We have carefully avoided the use of the term in this sense, since "power" has a different and perfectly definite signification. Power is defined as *the rate of doing work;* it is distinct from force or energy, and has a unit of its own. The following illustration may be useful in showing the difference between power and work.

Suppose there is a large tank for water on the roof of a building, the size of the tank and its height above the level of the place where the water is obtained being known, the amount of work necessary to be spent in filling it can easily be calculated. The rule has already been given. Now a steam engine and pump could do this work, a man walking up and down the stairs in the building and each time taking a pailful of water could do it, and a child with its tiny seaside bucket could also fill the tank if it kept on long enough and none of the water evaporated or was wasted in any way. When the tank is filled, the same amount of work has been done in each case; what is the difference between the three agents?

They take different amounts of *time* to do the work, or, in other words, they work at different *rates*, and hence from our definition they differ in *power*. The engine does the work quicker than the other two agents, hence it is said to have greater power. You see, then, that power involves not only the idea of work or energy, which in its turn involves force and distance, but it also includes *time*. The unit of time is fixed for us by the rotation of the earth on its axis, and is generally taken as the second, that is, $\frac{1}{86400}$th part of a mean solar day. Engineers are in the habit of taking any multiple or sub-multiple of a unit that suits their measurements, hence we find them using one minute as their unit of time in calculations relating to power, possibly because it is easier to obtain the speed of an engine in revolutions per minute than in revolutions per second. The unit of power originated with James Watt of steam-engine fame. He wished to have some unit by which he could express the powers of his different engines, and so he made some experiments by inserting a spring-balance between a horse and the waggon he was drawing, and he observed that the average pull of the horse was about 220 pounds, and that he walked about 150 feet per minute; hence doing 220 × 150 or 33,000 foot-pounds of work every minute. This is now definitely fixed as the engineer's unit of power, and has nothing to do with the power of any horse. The English unit of power (one horse-power) is defined as the *power required to do* 33,000 *foot-pounds of work in one minute.* It is slightly greater than the corresponding French unit, the *Force de Cheval*, the English horse-power being 550 foot-pounds per second, and the French only 542½ foot pounds (75 kilogrammetres) per second.

The electrical unit of power is one *watt*, which is about $\frac{1}{746}$th of the English horse-power, and is the power developed in an electric circuit when a current of one ampère flows through it under a potential difference, or electromotive force, or pressure of one *volt*. In all mechanical questions in which horse-power has to be found the student should adopt the following rule, *find the work done per minute and divide it by* 33,000. In questions involving the measurement of power electrically, the current and pressure are generally given in ampères and volts respectively, and the power in *watts* is obtained by *multiplying the volts and ampères together;* the *horse-power is obtained by dividing this product by* 746. The student can only get familiar with these measurements by working out numerical examples, and we will now endeavour to give a few of a practical and useful character.

NUMERICAL EXAMPLES.

Example 1.—A waterfall is to be utilised for electric lighting. The engineer who is sent to inspect the place and report on the power available, finds out the following data:—The water at one place flows in a straight rectangular channel, the width of which is 4 feet, and depth of water 2 feet, the average velocity of the water being 2 feet per second. If the available fall is 20 feet, the turbine water-wheels to be used have an efficiency of 60 per cent., and the dynamo an efficiency of 80 per cent., neglecting other losses of energy, find how many 60-watt incandescent lamps may be supplied (the weight of 1 cubic foot of water being taken as 62·4 lb.). The flow of water is

$$4 \times 2 \times 2 = 16 \text{ cubic feet per second,}$$
$$= 16 \times 60 \text{ cubic feet per minute,}$$

and the weight of water passing over the fall per minute is

$$16 \times 60 \times 62{\cdot}4 \text{ lb.,}$$

which falling 20 feet give

$$16 \times 60 \times 62{\cdot}4 \times 20 = 11{,}980{,}000 \text{ ft.-lb. every minute,}$$

hence the power is

$$\frac{11{,}980{,}000}{33{,}000} \text{ or } 336 \text{ horse-power (approximately)}$$

The combined efficiency of the dynamo and turbines is

$$\cdot 8 \times \cdot 6 = \cdot 48,$$

therefore there are only 363 × ·48 or 174 horse-power available for lighting purposes. Since 716 watts are equivalent to one horse-power, there are $\frac{746}{60} = 12{\cdot}4$ lamps lighted per horse-power; hence the total number supplied is 174 × 12·4, or about 2,157 lamps.

We do not say that the method of measuring the flow of water here indicated is at all accurate. Professor J. Thomson, of Glasgow University, discovered a very simple and accurate method of measuring the quantity of water flowing in such a case as that just given. The water to be measured is allowed to flow over a V-shaped notch cut in a board, as shown in Fig. 42, the notch being of the shape of a right-angled isosceles triangle and having sharp edges. The only measurement required is the height, h, of still-water level above the lowest point or angle of the notch. If this height is measured in feet, then the quantity of water, in cubic feet, flowing over the notch per second is obtained by *raising the number expressing this height to the fifth power, extracting the square root, and multiplying the result by* 2·645.

Example 2.—The method above described was employed to measure the flow of water in a certain stream, h being 1·3 feet. If this water drives a turbine water-wheel of 60 per cent. efficiency, the fall being 20 feet, find the power given out by the turbine. Answer, 6·93 horse-power.

In connection with the subject of power it is often of great importance to be able to calculate the power required to propel a vehicle, either along a level or up an incline of given slope. Usually the force or pull necessary to move the vehicle along a *level* road is given, this force being generally stated as a fraction of the weight of the vehicle; for instance, the *resistance*—which is equal and opposite to this force—of a tramcar varies from 20 to 30 lb. per ton of its weight, whilst for a good railway it is not more than 8 or 9 lb. per ton for moderate speeds, the road being level in both cases. If the vehicle is merely drawn along a level, the work done per minute is found by multiplying the distance it goes in feet by the total tractive force in pounds. If the vehicle is drawn up a hill, the work done may be divided into two parts; the first, that done in overcoming tractive resistances as on the level, and the second, that done in lifting the whole weight of the vehicle through the difference of level between its first and last positions. A few examples will make this clear.

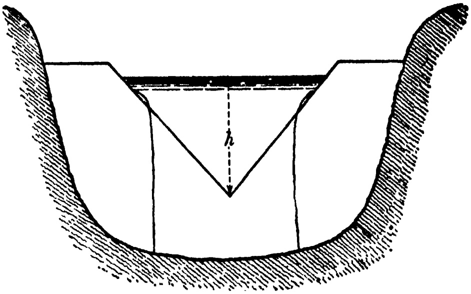

Fig 42.

Example 3.—Find the power necessary to propel a tramcar weighing 5 tons along a level road at the rate of 5 miles an hour, tractive resistances averaging 22 pounds per ton.

Here the force resisting motion is

$$5 \times 22 = 110 \text{ lb.}$$

The car moves

$$5 \times 5{,}280, \text{ or } 26{,}400 \text{ feet every hour,}$$
$$\text{or } 440 \text{ feet every minute,}$$

hence the work done per minute is force × distance

$$= 110 \times 440 \text{ ft.-lb.}$$

and the power required is

$$\frac{110 \times 440}{33{,}000} = 1\tfrac{1}{2} \text{ horse-power, nearly.}$$

The power required to *start* the car would, however, be considerably in excess of this.

Example 4.—Find the horse-power necessary to move a train weighing 150 tons up an incline of 1 in 100 at the steady speed of 30 miles an hour, resistances on the level at the same speed being 10 pounds per ton.

By an incline or gradient of 1 in 100, it is meant that for every 100 feet one moves up the slope he ascends 1 foot vertically; or that if 100 feet be measured along the slope, the two ends of this distance are at a difference of level = 1 foot.

The train moves

$$\frac{30 \times 5{,}280}{60} \text{ or } 2{,}640 \text{ feet in one minute.}$$

Resistances represent a force of

$$150 \times 10 = 1{,}500 \text{ lb.};$$

hence the work done per minute against ordinary tractive resistances is

$$1{,}500 \times 2{,}640 = 3{,}960{,}000 \text{ ft.-lb.}$$

In moving 2,640 feet up the slope the train rises

$$\frac{2640}{100} \text{ or } 26{\cdot}4 \text{ feet vertically,}$$

hence the work done against gravity in one minute is

$$150 \times 2{,}240 \times 26{\cdot}4, \text{ or } 8{,}870{,}000 \text{ ft.-lb.}$$

The total work done per minute is therefore

$$3{,}960{,}000 + 8{,}870{,}000 = 12{,}830{,}000 \text{ ft.-lb.},$$

and the power required is

$$\frac{12{,}830{,}000}{33{,}000} = 388{\cdot}8 \text{ horse-power}$$

The student should carefully work out the remaining examples.

Example 5.—The mean section of a stream is 8 feet by 2 feet, its mean velocity 2 miles per hour, and the fall at a certain point in the stream 12 feet. Find the power running to waste at this fall.

Answer, 63·8 horse-power.

Example 6.—The efficiency of a turbine is 70 per cent., and 5 cubic feet of water pass through it per second. What fall is necessary in order that 10 horse-power may be obtained from the turbine?

If this power is all given to a dynamo of 80 per cent. efficiency, which gives out an electric current at a pressure of 110 volts, find the current in ampères obtainable from the dynamo.

Answers, 25·22 feet, 54¼ ampères.

Example 7.—What is the power necessary to draw a train weighing 120 tons up an incline of 1 in 130 at the rate of 35 miles an hour, tractive resistances averaging 15·16 pounds per ton?

Answer, 362·76 horse-power.

Example 8.—A water-wheel giving out 20 horse-power is employed to drive a dynamo which generates the current for an electric tramway. If the combined efficiency of the dynamo, leads, motors, etc., is 30·4 per cent., and the weight of a train is 10 tons (resistances being 20 pounds per ton), find at what rate the train will move on a level road.

Answer, 11·4 miles an hour.

ITALIAN.—VI.

[*Continued from p. 289.*]

Vocabulary.

Altro, other.
Andrò, I shall go.
Bosco, forest, wood.
Cade, he falls.
Canto, *lato*, side.
Carta, f., paper.
Chi, who.
Dipendete voi, do you depend.
Discende, he is descended.
Dopo, after.
È gia partito, he has already departed.
Egli abita, *allogia*, *sta*, he lives or resides.
Egli è ritornato, he has returned.
È ritornata, she has returned.
È venuto, he came.
Genitore, father; *i genitori*, pl., parents.
Glascovia, Glagow.
Io sono tradito, I am betrayed.
Lontano, distant, far.
Lui, him.
Lungi, distant, far.
Me, me.
Mercante, merchant.
Miei, my (pl. m.).
Monte, mountain.
Napoli, Naples.
Nobile, noble.
Non è ancora uscito, he has not yet gone out.
Non si distingue, one does not distinguish.
Non volevano uscire, they did not want to go out.
Oggi, to-day.
Per tutto, *da per tutto*, everywhere, in all places, all over.
Poc' anzi (for *pô-co ánzi*), a little while or time before; lately, the other day.
Pranzerò, I shall dine.
Pranzo, dinner (*dopo pranzo*, after dinner, in the afternoon).
Presso, near, close to, with, about.
Quà, here; *di quà*, from here (also, on this side; through this place, through here; in this world or life).
Scende, he descends.
Schiatta, family, race.
Scorre giù, flows down.
Sono stato, I have been.
Stamattina (for *qué-sta mat-ti-na*, this morning).
Tetto, roof.
Uno, one.

Exercise 12.

Translate into English:—

1. É-gli è ri-tor-ná-to dal bô-sco. 2. È già par-tí-to da Ná-po-li. 3. Í-o só-no tra-dí-to da voi, da tút-ti. 4. Di-scên-de da ú-na schiát-ta nô-bi-le. 5. Lon-tá-no dai miê-i ge-ni-tó-ri. 6. Da chi di-pen-dé-te voi? 7. Non si di-stín-gue l'ú-no dall'ál-tro. 8. Non è an-có-ra u-scí-to dál-la cit-tà. 9. Da per tút-to. 10. Da un cán-to, da un lá-to. 11. Non vo-lé-va-no u-scí-re di quà. 12. Só-no stá-to da mí-a so-rêl-la. 13. Dó-po prán-zo an-drò da lui. 14. È ve-nú-to sta-mat-tí-na da me. 15. É-gli á-bi-ta, al-lôg-gia, sta da sú-o pá-dre (*or* in cá-sa di sú-o pá-dre; *or* prês-so sû-o pá-dre).

Vocabulary.

A, to.
A mio pá-dre, to my father.
A qué-sto giar-dí-no, to this garden.
Da, from, by.
Da mí-o pá-dre, from my father.
Dá-to, given.
Di mí-o pá-dre, of my father.
Di qué-sto giar-dí-no, of this garden.
É-gli á-ma, he loves.
Egli pén-sa, he thinks, directs his thoughts to.
Il lét-to, the bed.
Il cor-tí-le, the yard, court-yard.
Í-o á-mo, I love.
Í-o pén-so, I think, direct my thoughts to.
La stán-za, the room, chamber, apartment.
La tá-vo-la, the table.
Pre-stá-to, lent.

And not, *e non*.
Answer, *ri-spó-sta*, f.
Ball, *bál-lo*, m.
Cambridge, *Cam-brig-ge*.
Chase, *các-cia*, f.
Coffee-house, *caf-fè*, m.
Counting-house, *scrit-tó-io*, m.
Does he come, *viên' é-gli*.
Do you come, *ve-ní-te voi*.
Fishing, *pé-sca*,* f.

---

* Mind this important difference: *pé-sca*, fishing, fishing-place, fishery; and *pê-sca*, peach.

French, *fran-cé-se.*
Furniture, *i mó-bi-li*, pl. m.
Gentlemen, *si-gnó-ri*, m.
Has been already, *è gia stá-to.*
Has been sold, *só-no stá-ti ven-dú-ti.*
Has returned, *è ri-tor-ná-to.*
He comes, *é-gli vié-ne.*
Here is, *éc-co.*
His heir, *il sú-o e-ré-de*, m.
His, *sú-o.*
I come, *i-o vên-go.*
I expect, *i-o a-spét-to.*
Is a hundred and ninety miles, *ci só-no cên-to no-ván-ta mi-glia*, pl.
Is expected, *vié-ne a-spet-tá-to.*
Is far shorter than (the transition), *è as-sá-i più cór-to che non è il pas-ság-gio.*
Is not far, *non è lon-tá-no.*
John, *Gio-ván-ni.*
Latter, *úl-ti-mo*, m.
Money, *da-ná-ro*, m.
Month, *mé-se*, m.
No, sir, *non si-gnó-re.*
No, we come, *nò* (pron. *nô*), *ve-niá-mo.*
Other, *ál-tro.*
Oxford, *Os-fôr-dia.*
Paris, *Pa-rí-gi.*
Play (comedy), *com-mê-dia*, f.
Return, *ri-tór-no*, m.
Riding-school, *ca-val-le ríz-za (ts)*, f.
Shop, *bot-té-ga*, f.
This depends, *qué-sto di-pên-de.*
Three, *tre.*
To-day, *ôg-gi.*
Transition, *pas-ság-gio*, m.
Vice, *ví-zio*, m.
Virtue, *vir-tù*, f.
Walking, *pas-ség-gio*, m.
Where do . . . come from, *dón-de vên-go-no.*
Which has been sent to me, *che mi è stá-to spe-dí-to.*
William, *Gu-gli-él-mo.*

EXERCISE 13 (COLLOQUIAL).

Translate into Italian :—

1. He comes from the riding-school, and not from the garden. 2. From Hamburg to Paris is a hundred and ninety French miles. 3. Does he come from the shop? 4. Do you come from the play? 5. No, we come from the ball. 6. The furniture of Mr. Hall has been sold by his heirs. 7. Where do these gentlemen come from? 8. Some return from the chase, others from walking, and these latter from fishing. 9. Here is the money which has been sent to me by the father. 10. This depends on the mother, and not on the brother. 11. The transition from virtue to vice is far shorter than from vice to virtue. 12. I expect an answer from John; he has been already three months in London. 13. William has returned to-day from Paris.

THE PREPOSITION *IN.*

The preposition *in* denotes being, continuance, or motion *in the interior* of a thing. It also denotes any kind of motion or penetration *into* it. The idea of existence *in a time* or *in a certain condition*, particularly *in a certain state* or *disposition of the mind*, likewise requires the use of *in*. The preposition *a*, on the contrary, merely expresses presence *near* or *about* a thing, or motion, approach, and tendency *to* it. For example :—

É-gli è nel giar-dí-no, in quél-la cá-me-ra, in cit-tà, in piáz-za, he is in the garden, in that room, in the town, in the square.

É-gli an-drà in In-ghil-têr-ra, in I-spág-na, he will go to England, to Spain.

Nell'án-no mil-le sét-te cên-to, in the year 1700.

Ge-sù Crí-sto nác-que in Be-tlêm-me, Jesus Christ was born in Bethlehem.

Im-mér-ge-re ú-no nel-l'á-cqua, to plunge one in the water.

É-gli é ra qui in quest'i-stán-te, he was here (in) this moment.

in a-go-ni-a, he lies in the agonies of death.

A-vér quál-che có-sa in bóc-ca, in má-no, to have something in one's mouth, in one's hand.

Ca-scá-re in ú-na fôs-sa, to fall into a pit or hole.

Mét-te-re le má-ni in tá-sca, to put or thrust one's hands into one's pockets.

The motion to or towards a *town* or *village*, conformably to the nature of the preposition, is always expressed by *a*.

Usage allows the omission of the article after *in* before many nouns familiarly known and constantly recurring in conversation; for example, *é-gli va nél-la cá-me-ra, nél-la cit-tà, nél-la chiê-sa, nél-la can-tí-na*, etc., or, *é-gli va in cá-me-ra, in cit-tà, in chiê-sa, in can-tí-na*, etc., he goes to the room, to the town, church, to the cellar, etc.

Before the words *day, week, month, year, morning, evening*, when *time* is the subject, it is customary to omit the preposition *in;* for example, *l' án-no che mo-rì il Ga-li-lê-o, nác-que il Newton*, in the year in which Galileo died, Newton was born.

The words *cá-sa, cór-te, pa-láz-zo, teá-tro, lêt-to*, and *scuó-la* have a proper or original and a figurative signification. In the former case they demand the preposition *in;* in the latter, the preposition *a* (without an article) before them. For example :—

É-gli è nél-la cór-te, nel pa-láz-zo, in teátro, in lét-to, in i-scuó-la, in ca-sa.	He is in the court-yard, in the palace, in the theatre, in the bed, in the school (*i.e.* building), in the house.
É-gli e a cór-te, a pa-láz-zo, a téa-tro, a lêt-to, a scuó-la, a cá-sa.	He is at court, at Guildhall, at the play, sick in bed, at school, at home.
I-o vá-do nél-la cór-te, nel pa-láz-zo, nel teá-tro, nel lét-to, nél-la scuó-la, nél-la cá-sa.	I go into the court-yard, into the palace, into the theatre, into the bed, into the school (*i.e.* building), into the house.
I-o vá-do a cór-te, a pa-láz-zo, a teá-tro, a lêt-to, a scuó-la, a cá-sa.	I go to court, to Guildhall, to the play, to bed (*i.e.* to sleep), to school, home.

In addition to these uses, *in* has some indefinite meanings, which will admit of several prepositions or adverbial expressions for the purpose of translating them into English. For example :—

No-mi-ná-re, dí-re quál-che cô-sa in la-tí-no, to name, say something in Latin.

Spe-rá-re in Dí-o, to hope in God.

Por-tá-re quál-che có-sa in dôs-so, in té-sta, in cór-po, to carry something on one's back or shoulders, or about one's self, on the head, on the body.

Con-fic-cá-re in ú-na cró-ce, fasten or nail something to a cross.

In me mo-vên-do de' bé-gli ôc-chi i rá-i, turning towards me the rays of her beautiful eyes.

Vi-de in se ri-vól-to il pó-po-lo, he saw the people rebelling against him.

Guar-dá-re in ú-no, to look at one.

Dá-re quál-che có-sa in dó-no ad ú-no, to give one something as a present.

In av-ve-ní-re, in future, for the future, henceforth.

In frét-ta, in a hurry, hastily.

In fác-cia, to one's face.

VOCABULARY.

Adltava, he lived.
Abesso, now.
Alquanto, m., *alquanta*, f., some, several.
Anno, year (*il fior degli anni* or *dell' eta*, the bloom of youth, flower of life, prime of one's age).
Antonio, Anthony.
Avete avuto, you have had.
Non c'e nessuno, there is nobody.
Camera, chamber, room.
Campagna, country.
Cantina, cellar.
Capacita, ability, talent, skill.
Carrozza, coach, carriage.
Carta, f., paper (*cartapecora*, vellum).
Collera, anger.
Copia, f., abundance, plenty; occasion; copy.
Cortile, court-yard.
Cucina, kitchen.
È andato, he is gone.
È partito, he has departed.
E qui l'aspetto, and here I wait till he comes.
Egli va, he goes.
Essi sono sortiti, they have gone out.
Fiore, flower, bloom, prime.
Fretta, haste, hurry, precipitation.
Io mi riposo, I repose myself, sit down; I rely.
Letto, bed.
Lo prevenni, I came before him.
Lo trovai, I found him.
Mano, f., hand.
Me, me.
Morirono amendue, both died.
Ora, hour.
Osteria, public-house, tavern, inn.
Piazza, market-place, square.
Fiede, foot, leg (*punta del piede*, end or point of the foot, *i.e.*, toe).
Porto, port, harbour.
Potremo andar, we shall be able to go.
Punta, point (of anything).
Punto, point, point of time, moment.
Quasi, almost, nearly, well-nigh.
Scozia, Scotland.
Se ne parla, they talk of it.
Se ne stamperanno, will be printed.
Siete, you are.
Slitta, sledge.
Sono, I am.
Stanza, f., room, chamber.
Teatro, theatre, playhouse.
Tempo, time, leisure, weather.
Tu eri, thou wast.
Turchia, Turkey.
Vi è andato, he is gone there.
Viaggio, journey.
Vicino, m., *vicina*, f., neighbouring, contiguous, adjoining, adjacent.
Villeggiatura, summer season, for pleasure or recreation spent in the country (*essere in villeggiatura*, to spend the summer season in the country)
Voi siete, you are.

EXERCISE 14.

Translate into English:—

1. Él-la è nél-la stánza vi-cí-na. 2. Só-no quá-si in pôr-to. 3. É-gli è in Áu-stria, in I-tá-lia, in cam-pá-gna, in vil-leg-gia-tú-ra. 4. É-gli va nel giar-dí-no; in quél-la cá-me-ra; in Frán-cia; in cam-pá-gna; in I-scô-zia; in Tur-chí-a. 5. É-gli è nel cor-tí-le, nél-la cu-cí-na, nél-la can-tí-na. 6. È an-dá-to in chiê-sa, in cit-tà, in piáz-za, in teá-tro. 7. A-bi-tá-va in quél-la cá-sa. 8. Lo tro-vá-i in lêt-to. 9. An-tô-nio è in côl-le-ra con me. 10. Se ne pár-la in tút-ta la cit-tà. 11. È par-tí-to in frét-ta. 12. Vi è an-dá-to in car-rôz-za. 13. És-si só-no sor-tí-ti in qué-sto pún-to. 14. A-dês-so siête nél-le mí-e má-ni. 15. Lo pre-ce-dét-ti in pún-ta di piêdi e qui l'a-spêt-to. 16. Í-o mi ri-pô-so nél-la ca-pa-ci-tà di mí-o fra-têl-lo. 17. Al-quán-te cô-pie se ne stam-pe-rán-no in cár-ta pe-cô-ra. 18. Voi siê-te nel fiór dé-gli án-ni.

EXERCISE 15.

Translate into Italian:—

1. My uncle's garden is very large. 2. We have seen thy father's table and bed. 3. I have received this cloak from my aunt. 4. Have you received a book from this child? 5. We have lent our umbrella to your brother. 6. Have you found this pen in your school? 7. We have written a letter to our uncle and to our aunt. 8. Your mother has given a cap to my sister. 9. Have you seen a little child in our garden?

VOCABULARY.

Agreeable company, *ag-gra-dé-vo-le com-pa-gni-a*, f.
Anger, *cól-le-ra*, f.
Book, *lí-bro*, m.
Castle, *ca-stél-lo*, m.
Cellar, *can-tí-na*, f.
Consolation, *con-so-la-zió-ne*, f.
Count, *cón-te*, m.
Direction, *in-di-ríz-zo*, *di-re-zió-ne*.
Drunkenness, *ub-bria-chéz-za* (*ts*), f.
Find, *trô-va-no*.
Fine weather, *bêl têm-po*, m.
Has gone out, *e u-sci-to*. [*sco-se*.
He hid, *é-gli* ....
Hope, *spe-rán-za*, f.
In some respects *per di-vêr-si* .. *guár-di*.
Is not, *non è*.
Is there nobody? *c'è nis-sú-no?*
Key, *chiá-ve*, f.
Kitchen, *cu-cí-na*, f.
Man, *uó-mo*, m.
Means, *méz-zi*, m.
Never is better known than, *non si co-nó-sce má-i mé-glio che*.
Passes very quickly, *pás-sa as-sá-i pre-sto*.
Play, *giuó-co*, m.
Room, *cá-me-ra*, f.
Shall we go to take our breakfast? *vo-gliá-mo an-da-re a far co-la-zio-ne?*
She must either have gone—or, *él-la sa-rà an-da-ta —o*.
Steward, *fat-tó-re* (or *ca-stál-do*), m.
Summer-house, *ca-si-nét-to*, m.
That sideboard, *quell'ar-má dio*, m.
This moment, *qué-sto pún-to*, m.
This note, *qué-sto bi-gliét-to*, m.
Time, *têm-po*, m.
To become learned, *per di-ve-nir dôt-to*.
Unfortunate, *in-fe-lí-ce*, m.
We find, *si tró-va-no*
You have had, *voi a-vé-te a-vú-to*.
You will have, *voi a-vré-te*, *ella avrà*.
Your journey, *il vô-stro viag-gio*, m.

EXERCISE 16.

Translate into Italian:—

1. The unfortunate find consolation in hope. 2. Your sister is not in the room, she must either have gone into the kitchen or into the cellar. 3. Shall we go to take our breakfast in the summer-house? 4. In an agreeable company time passes very quickly. 5. Is nobody in the castle? 6. No, the steward has gone out (*in*) this moment. 7. You have had fine weather for your journey. 8. You will have in this note the count's direction. 9. He hid the key in that sideboard.

THE PREPOSITION *CON*.

When the preposition *with* denotes company, society, union, community, connection, or when it denotes the instrument or means by which something is effected, it coincides with the use of *con* in Italian. In the former case, the words *together with*, *besides*, *to*, or similar ones, and in the latter the words *by means of*, *by agency of*, *by dint of*, *by*, *through* are frequently equivalents of *with*, and are translated by *con*. For example:—

An-dá-re col fra-têl-lo, to go with the brother.
És-se-re, *stá-re con ú-no*, to be with one, to belong to one; *i.e.*, to one's family, company, etc.
Com-bat-te-re col ne-mí-co, to fight with the enemy.
Con-cer-tá-re ú-na cô-sa con ú-no, to concert a thing with one.
Pa-ra-go-ná-re ú-na có-sa con un'al-tra, to compare one thing with another.
Con qué-ste má-ni, with these hands.
Con fró-de ed in-gán-no, with fraud and deceit.
Con un col-têl-lo, with a knife.
La-vo-rá-re cól-la li-ma, col pe work with the file, with the [illegible]
Fá-re ú-na cô-sa con pia-cé-re, *con do-ló-re*, *con* [illegible], *con dif-fi-col-tà*, *con de-stréz-za*, *con buón gár-bo*, to do a thing with pleasure, with grief, with ease, with difficulty, with skill, with good grace.

Con, before an infinitive, which in this case occupies the place of a real noun, is quite an idiom, and will be best translated by the prepositions *by*, *through*, by the conjunctions *while*, *when*, *as*, and particularly *and*, or by the *present participle* of the English verb.

VOCABULARY.

Andar, to go, going, pace, walk, course.
Bottone, button.
Coda, tail.
Colore, colour.
Colpo, blow, knock, shot.
Con sua buona grazia, with your kind permission.
Egli lo prese, he took it.
Favorite, please.
Fazzoletto, handkerchief, pocket-handkerchief.
Forza, power, strength, force (*con ogni forza*, or *con tutta la forza*, with all one's might, with might and main, by main force).
Fu ucciso, he was killed.
Garbo, good grace, pleasing manners (*bel garbo*, address, skill).
Grazia, grace, charm, favour, kindness, permission, gracefulness.
Guardar, to look.
Lanterna, lantern.
Magnificenza, magnificence (*con ogni magnificenza*, most magnificently or superbly).
Me, me.
Meco, with me.*
Mi disse, he told me.
Non s'accordano, do not match.
Occhio, eye (*guardar uno colla coda dell'occhio*, to look at one from the corner of one's eyes, generally from contempt, also from suspicion or envy, to look askance or cast a suspicious glance at one, to look at one with an evil eye).
Ogni, each, every, all.
Parlando, speaking (*con rispetto parlando*, with respect).
Pistola, pistol.
Poco, little (*poco garbo*, want of good grace, unskilfulness, awkwardness).
Porta, carry.
Rispetto, respect, regard, deference.
Salvo, m., *salva*, f., safe, secure, saved, unhurt.
Se, himself, him.
Sembiante, visage, face, countenance, appearance, air, aspect.
Si netta, he wipes himself clean.
Studio, study, diligence, care (*con istudio* or *a studio*, on purpose, intentionally).
Stupore, astonishment, surprise, amazement.
Te, thee.
Temperare, to mix, dilute.
Tempo, time (*coll'andar del tempo* or *col tempo*, in time, in time to come, hereafter).
Turbato, disturbed, alarmed, troubled.
Venia, f., remission, forgiveness (*salva venia*, with your permission).
Venir, to come.
Via di quà, away with.
Vino, wine.

EXERCISE 17.

Translate into English:—

1. Guár-dar cól-la (con la) có-da dell'ôc-chio. 2. Fa-vo-rí-te di ve-nir con me (or *mé-co*). 3. Pôr-ta té-co (con te) la lan-têr-na. 4. É-gli lo pré-se sé-co (con se). 5. Coll'an-dâr del têm-po. 6. Fu uc-cí-so con un cól-po di pi-stô-la. 7. Con sem-bián-te tur-bá-to mi dís-se. 8. Con i-stú-dio. 9. Con i-stu-pó-re. 10. Ví-a di quà con qué-sta côsa. 11. Con bêl gár-bo (or *con bêl-la grá-zia*). 12. Con pô-co gár-bo. 13. Con sú-a buô-na grá-zia. 14. Con ó-gni ma-gni-fi-cên-za. 15. Con ó-gni fôr-za.

VOCABULARY.

A-dôl-fo, Adolphus.
Am-ma-lá-to, distempered, diseased, out of health, sick, ill.
An-có-ra, yet, still, also, even, again.
An-tó-nio, Anthony.
Ar-ri-vá-to, arrived.
Ca-ro-li-na, Caroline
È di, belongs to, (*i.e.*, is of).
En-rí-co, Henry.
Fer-di-nán-do, Ferdinand.
Fran-cé-sco, Francis.
Gió-va-ne, young.
Gu-gli-él-mo, William.
Il giar-di-niê-re, m., the gardener.
Il gió-va-ne, the young man, youth.
Il sér-vo, m., the servant.
Il sol-dá-to, m., the soldier.
Il vi-ci-no, m., *la vi-ci-na*, f., the neighbour.
L'ál-be-ro, m., the tree.
L'a-mi-co, m., the friend; *l'a-mi-ca*, f., the female friend.
L'uómo, m., the male person, human being, man, husband.
La dôn-na, f., the woman, wife, lady, mistress.
La giar-di-niê-ra, f., the female gardener, the gardener's wife.
Lôn-dra, London.
Lo sco-lá-re, m., the pupil, learner, scholar.
Lo scul-tó-re, m., the sculptor, statuary.
Lu-i-gi, Lewis, Louis.
Lu-i-gia, Louisa.
Pa-ri-gi, Paris.
Par-ti-to per, departed for.
Pó-ve-ro, poor, needy, wanting.
Ric-co, rich, wealthy.
Ro dôl-fo, Rodolph, Ralph.
Si chiá-ma, is called.
Sté-fa-no, Stephen.
Ve-né-zia, Venice.
Vien-na, Vienna.

EXERCISE 18.

Translate into Italian:—

1. My book is on the form. 2. I have given my hat to this poor child. 3. The book which I have received from a friend is lost. 4. Have you (*sing.*) found Charles's ring? 5. John's garden is very small. 6. William's friend has departed. 7. My cousin has (*i.e.*, is) arrived. 8. We have received a letter from Louis; he is at Milan. 9. Rodolph has departed for Venice. 10. Have you (*sing.*) seen the watch of Lewis? 11. Has (*i.e.*, is) your (*sing.*) uncle departed for Paris? 12. Caroline's aunt is in London. 13. Our (male) neighbour has a son, who is called Adolphus, and a daughter who is called Louisa.

VOCABULARY.

And we always have to do, *e si ha da far sém-pre.*
Came here, *ar-ri-vo qui.*
Coach, *car-rôz-za*, f.
Country, *cam-pá-gna*, f.
Courier, *cor-rié-re*, m.
Cousin, *cu-gí-no*, m.
Dead, *mór-to*, m.
Express order, *ór-di-ne es-prés-so*, m.
For, *per.*
First part, *prí-ma pár-te*, f.
General, *ge-ne-rale*, m.
Has gone to dine, *è an-dá-to a pran-zá-re.*
Himself, *se stésso.*
His life, *la su-a ví-ta.*
Horse, *ca-vál-lo*, m.
Is filled with, *è pié-no di.*
Last, *úl-ti-mo*, m., *úl-ti-ma*, f.
Living, *ví-vo*, m.
Nephew, *ni-pó-te*, m.
News, *nuó-va*, f.
Next, *ven-tú ro*, m., *ven-tú-ra*, f.
Ought to spend, *dé-ve pas-sá-re.*
Park, *par-co*, m.
Peace, *pá-ce*, f. (*i.e.*, news of the peace).
Second, *se cón do*, m., *se-cón-da*, f.
(There) has arrived, *è giún-to.*
They will go, *vó-glio-no an-dá-re.*
Together (all), *tut-ti in sié-me.*
To buy, *di com-prá-re.*
Ungrateful (person), *in-grá-to*, m.
We live, *si ví-ve.*
We work, *si la-vó-ra.*
Week, *set-ti-má-na*, f.
World, *món-do*, m.

EXERCISE 19.

Translate into Italian:—

1. The nephew has gone with the general's son and daughter into the park to dine there. 2. Next week they will go together into the country. 3. A courier has arrived with the news of the conclusion of peace. 4. The cousin came here with the express order to buy a horse and a coach. 5. The world is filled with ungrateful persons; we live with the ungrateful, we work for the ungrateful, and we always have to do with the ungrateful.

KEY TO EXERCISES.

Ex. 9.—1. This horse is beautiful. 2. This snuff-box is very small. 3. This inn is large. 4. This child is my brother. 5. This penknife is for my brother. 6. Your little sister has a handsome book. 7. My mother has bought this hat. 8. Thy brother has seen this fine carriage. 9. Your little brother is a good child. 10. This watch is very good. 11. This beautiful ring is for this child. 12. My uncle has a son and a daughter. 13. We have received a present. 14. Have you written a letter? 15. My sister has received a fine cap. 16. Hast thou also sold thy carriage? 17. This present is for your aunt. 18. My daughter is very tall. 19. This father has a beautiful daughter. 20. This child is my son. 21. The garden that I have seen is very large. 22. My father has lost his hat and his umbrella. 23. Our uncle has sold his beautiful carriage.

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* In the place of *con me*, with me; *con te*, with thee; and *con se*, with himself, herself, itself, themselves, *meco*, *teco*, and *seco* are frequently used; and in elegant style *con* as a mere expletive, *con meco*, *con teco*, *con seco*.

Ex. 10.—1. I tempi d'adesso non sono i migliori. 2. Egli si era nascosto nella stanza di dietro. 3. La nostra città ha un ponte di pietra, la vostra ne ha solamente uno di legno. 4. Eduardo ha ricevuto da Londra un oriuolo d'oro, una spada d'argento, e un paio di fibbie d'acciaio. 5. Una volta si portavano degli abiti di panno e de' gilè di velluto. 6. L'uso dei vasi di rame è stato proibito in Svezia. 7. Che significa questo suono di campane? 8. Che dite del panno che ho comprato? 9. Esso è buono e fino. 10. E del colore? 11. Esso e bello. 12. Ecco dieci braccia del taffetà che volevate avere, e dodici braccia della tela batistà che avete domandata.

Ex. 11.—1. I have sent the letter to John. 2. To shoot at a bird. 3. The merchant thinks of profit. 4. From words they came to blows. 5. To whom have you shown it? to Peter or to the cousin? 6. What are you thinking of? 7. I am thinking of the future. 8. Shall we soon arrive at the next post? 9. He ran immediately to the door. 10. He spoke to a stranger. 11. He provoked him to anger. 12. His conversation becomes tedious to me. 13. He reckons it a dishonour. 14. Liberality is imputed to him as a fault. 15. They were at the chase, the wedding, the dinner, the supper, the ball. 16. I shall go to a ball to-morrow. 17. They go for amusement; to take a walk. 18. Let us go to the coffee-house. 19. Which is the way to the post? to the custom-house? 20. He is at Berlin.

ACOUSTICS.—II.

[*Continued from p.* 299.]

FACTS CONNECTED WITH THE PRODUCTION OF SOUND—VIBRATIONS OF STRINGS, RODS, PLATES, BELLS, REEDS, AND AIR IN PIPES—KOENIG'S MANOMETRIC FLAMES

IN the last lesson we saw that sound is the result of vibratory motion, and that it is made known to us through the sense of hearing due to the action of the tremors in the air on the minute nerves of the internal ear. We saw, too, that sound may be of the kind which we call *noise*, or it may be *musical*. It is very difficult to define the exact line of demarcation between the two, for noises which are themselves unmusical may blend with others so as to produce a pleasing effect, as the tap of the drum or the clash of cymbals; and even the roar of the traffic in the great city may become mellowed by distance into an agreeable hum. The commonest source of non-musical sounds is the shock of bodies striking together; friction, electrical discharges, and explosions of inflammable substances also furnish irregular sounds of particular kinds. Sounds of the large and more distinct class, in which the vibrations are of a regular kind, are of more interest to us, and in this lesson we propose to discuss some facts connected with the *production* of such sounds.

VIBRATING STRINGS.

We have already referred to one of the commonest sources of musical sounds, viz., vibrating strings. These have been employed for the production of such sounds in nearly all countries, and from a very early period. If the string is uniform in thickness and texture and *flexible*, its vibrations may be *transverse*, *longitudinal*, or *torsional*. Transverse vibrations are the most usual and of greatest interest. This mode of vibration may be studied with the help of the *sonometer* or *monochord*, which is shown in Fig. 10.

It consists essentially of a single wire or cord, *m n*, the length and tension of which can be varied. One end of this is fixed to a peg at the extreme left of the instrument; the other end passes over a pulley, and has a number of weights suspended from it, by means of which the tension can be altered at pleasure. Two bridges, *m* and *n*, are placed under the cord, one near each end; these form its virtual extremities, and rest upon the hollow sounding-box which forms the base of the instrument. When the wire is set in vibration, the pulsations are conveyed through these bridges to the sounding-box, and thus to the body of air contained in it. In this way the power of the sound is very materially increased.

If we were merely to suspend the cord from a fixed hook, placing a weight at the lower end to keep it stretched, and then to set it in vibration, we should easily discern its vibrations by the eye, but scarcely any sound would be produced, as there is no vibrating body to which its motion would be imparted. In the sonometer the cord vibrates in just the same way, but the sounding-box enables us to hear as well as to see the vibrations.

At the back of the instrument is a scale, on which the distance between *m* and *n* is divided into one hundred equal parts, and a movable bridge, *o*, can be placed at any part of this, so as to touch the string in any required place, and damp its vibrations there.

If now we remove *o* altogether, and pluck the string in the centre, or draw a violin-bow across it, we shall obtain a sound which is the fundamental note of the string, the whole of which will be thrown into vibration, as shown at A (Fig. 11). Now place the bridge, *o*, at the division of the scale marked 50—that is, midway between *m* and *n*—and excite one division of the string by means of the bow, as before. Both parts will at once be thrown into vibration, and the cord will present the appearance shown at B; but the note produced will be found to be just an octave higher than the fundamental note of the string.

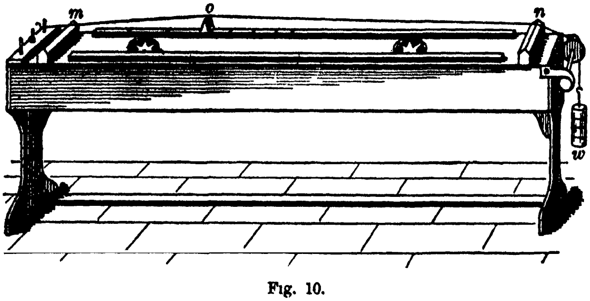

Fig. 10.

Now move the bridge, *o*, to nearly the division marked 33, so as to be one-third of the way along the cord, and draw the bow across the segment, *a b*. We shall now obtain a note a fifth higher than the octave, and the portion *b d* of the cord (Fig. 11, C) will be seen to be divided into two ventral segments, as they are termed, separated by a node, or place of rest, *c*. The existence of this may easily be shown by placing three bent pieces of paper astride the cord at the points *e*, *c*, and *f*, and then exciting it as before. Those placed at *e* and *f* will at once be jerked off, while that at *c*, being placed at a node, will remain unmoved, showing that the cord there is at rest.

By moving the bridge to the division 25, we shall find the whole length of the cord divided into four segments (D, Fig. 11). The sound produced in this case will be just two octaves above the fundamental note. The divisions may be rendered manifest, as before, by placing pieces of paper on the wire.

In these experiments we may dispense with the bridge altogether, and damp the cord at any required place by lightly touching it with a feather. As a result of them all, we find that the shorter the vibrating segments are, the higher will be the note produced. By diminishing their length a half we raise the note an octave, and, as we have already seen, this is produced by doubling the number of vibrations in any given time. We thus obtain the following fundamental rule:—*The number of vibrations in the same time varies inversely as the length of the string, the tension remaining unaltered.*

The next thing that modifies the note produced by a string is its tension. Experimental proof of this fact can easily be obtained by altering the weight at *w*, or, easier still, by varying the pressure by the hand. By carefully experimenting in this way we shall find that, by increasing the tension fourfold, we raise the note an octave; that is to say, we produce double the number of vibrations. The second general law, then, may be stated as follows:—*The number of vibrations made by the cord in any given time varies as the square root of the tension.* It is by varying the tension of the wires that a piano is tuned; the wires usually yield a little by the constant blows of the hammers, and thus the notes become somewhat flat, and have to be tuned up to their former standard.

The diameter of the cord likewise affects its rate of vibration. If we take two cords of the same substance, similar in tension and length, but one of which has twice the diameter of the other, we shall find that the note produced by the thicker one is an octave below the other. It follows that strings of the same length and density, but of different thicknesses, will have the same vibration rates if *stretched by forces proportional to their sectional areas.* The density of the cord also affects the tone produced by it. In fact, all other things being equal, the *vibration frequencies of two strings are inversely as the square roots of their masses or weights.* It is on account of this fact that the wires of a piano are much thicker in the bass than in the treble, and those for the lowest notes of all are frequently wound round with thin wire.

Longitudinal vibrations may be set up in strings by rubbing them in the direction of their length with a piece of rosined leather, the sounds produced being of a very much higher pitch than those due to transverse vibrations. Such sounds are not used to any extent in music. The vibration frequency follows the same rule as that for transverse vibrations. Since the length of any string varies when vibrating transversely, it must also vibrate longitudinally, and in the violoncello the effect of these vibrations is the production of "false" notes or tones.

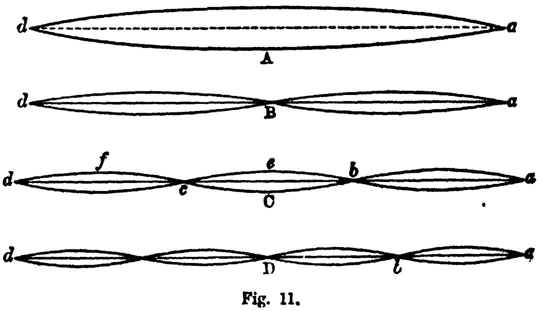

Fig. 11.

Torsional vibrations.—Besides the two modes of vibration referred to above, the string may also vibrate with a *torsional* motion, which can be made evident by attaching a ring with a paper flier to the centre of the string. When the string is plucked or bowed, the flier rotates, showing the torsional motion. Dr Stone—to whose excellent little book on sound we are much indebted—mentions the difficulty attending the production of *grave* tones by enlarging the sectional area of the string, owing to the sounds introduced by the torsional vibrations of the string.

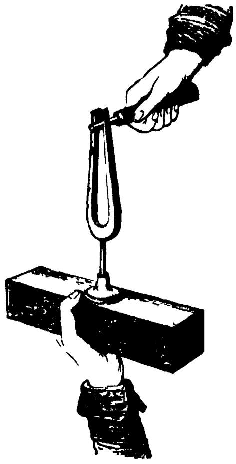

Fig. 12.

VIBRATIONS OF RODS AND BARS.

Here again we have the three kinds of vibrations, the transverse being of greatest importance. When a rod is fixed at both ends and caused to vibrate, it behaves like a string—vibrating in one, two, or more segments, but the rapidity of vibration differs from that of a string. Thus when a string is divided into *two* segments, each of these vibrates twice as fast as the whole string would do, whereas a rod in a similar case vibrates with a rapidity increased in the ratio of 25 to 9; with two nodes and three segments the ratio is 49 to 9; three nodes and four segments 81 to 9, and so on.

A rod fixed at *one* end has already been referred to. It gives a number of vibrations which is inversely as the square of its length; and notes may be produced, the period of the gravest tone being the time occupied by a pulse in travelling *four times* the length of the rod.

A common application of this mode of vibration is to be met with in the "Jew's harp," a well-known toy musical instrument in which the tone is modified by changes in the cavity of the mouth; also the gong of an American clock, in which a coiled piece of wire is fixed at one end to a sounding iron, and struck near the other by the hammer of the mechanism. A tuning-fork, such as that shown in Fig. 12, may be regarded as a bar fixed at the middle and free at the ends. It gives out not only the fundamental note but numerous upper partials, the interval between them and the lower tone being much greater than in the case of strings; they are, therefore, less noticeable than in strings, and on account of the comparative purity and simplicity of its tone it is much used in researches on sound. The note produced has, however, the great disadvantage of rapidly falling off in intensity, due to friction. When placed on a sounding board or box, as shown in the last figure, the note is more sustained. Electric and other methods have been devised by which the fork may be kept vibrating for a length of time. Tuning-forks are also much used in experiments in other departments of physics.

The only example of the application of longitudinal vibrations in rods which we shall notice is that furnished by Marloye's harp, Fig. 13. It consists of a number of deal rods standing vertically on an oblique-shaped sounding board, into which the lower extremities of the rods are fixed. These rods are caused to vibrate by rubbing them in a longitudinal direction with the rosined fingers. A similar instrument furnished with *glass*, instead of wooden, rods has also been used. The torsional vibrations of rods are of little importance.

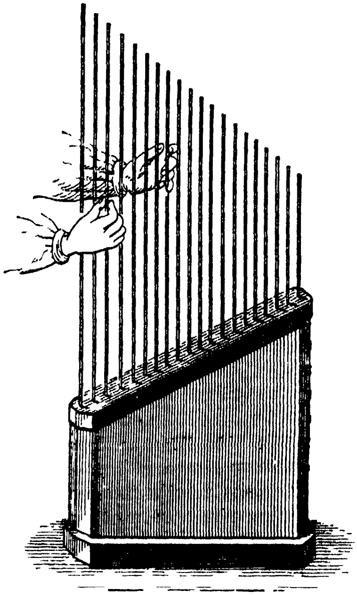

Fig 13

Vibrations of plates.—When plates are set vibrating, the presence of nodes can easily be demonstrated by sprinkling some light powder on the plates; this powder leaves the vibrating segments to heap itself on the nodes, or places of rest. In this way most beautiful figures have been obtained by Chladni, and subsequently by Wheatstone. The method of investigation is to support plates of different shapes, but regular outline, by a proper clamping arrangement. Sand having been sprinkled on the plates, they are then excited by a rosined bow, as shown in Fig 14, and the vibrations of the plates being damped by placing the fingers at proper places on them, a great variety of beautiful figures are assumed by the sand. Some of these, as found by Chladni and Savart for square plates, are shown in Fig. 15, circular plates vibrating somewhat as shown in Fig. 16. The vibration-frequency—say in a circular disc—is proportional to its thickness, and inversely proportional to the square of its diameter.

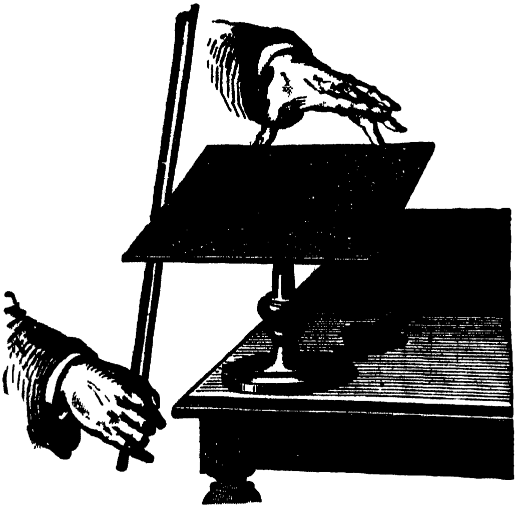

Fig 14.

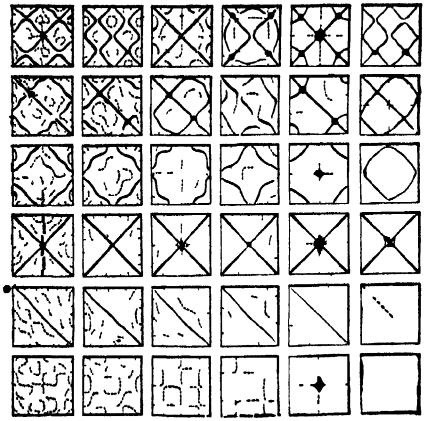

Fig 15.

Vibrations of bells.—Gongs and some ancient bells are very much like plates. Bells are usually of a more or less hemispherical shape, and are generally excited by being struck. They give a tone which is anything but pure, having many upper partials or harmonics. The nodes in a bell are shown in Fig. 17. In church bells the hemispherical shape is departed from considerably, and the tone is not so pure as if that shape were retained, as it is to a greater extent in the case of clock chimes. The latter, however, from their shape cannot readily be rung in peals. Bells are usually made of bell-metal—an alloy of copper and tin, of about 75 parts by weight of copper to

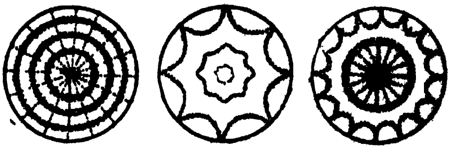

Fig. 16.

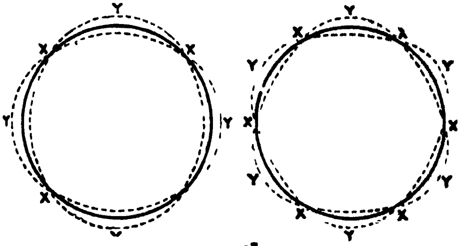

Fig. 17.

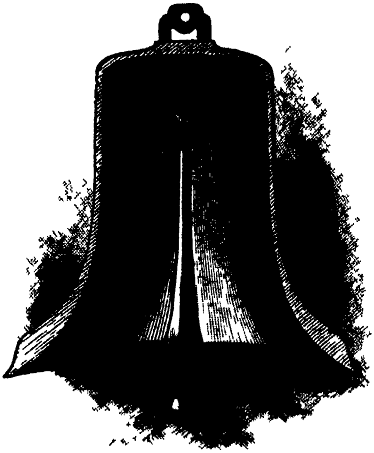

Fig. 18.

25 of tin. The supposed good effect produced by the addition of a little silver seems to be purely imaginary. A section of a bell is shown in Fig. 18.

Musical glasses, selected so as to form roughly a sort of scale and tuned by being partially filled with water, have been used to produce music, being excited by rubbing the edge with the wetted finger.

Reeds and organ pipes.—These can best be considered together. Reeds consist of elastic pieces of wood or metal usually fixed at one end and vibrating at the other. Reeds are usually divided into two classes, *free*, and beating or *striking* reeds. In the latter the reed overlaps the orifice, whereas in the former it vibrates freely between the edges of the opening. Most orchestral reed instruments, and all the older forms of organ pipes, have *beating* reeds.

Vibrations of columns of air in pipes.—In wind instruments the confined column of air is the sonorous body. It is confined in a pipe usually of a cylindrical or prismatic shape. The air is set in vibration by impinging on a ridge-shaped piece or on a reed.

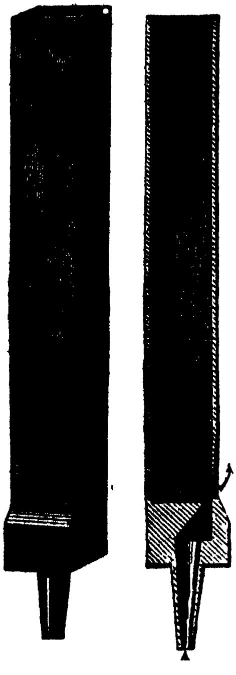

Fig 19.

One very common form of organ pipe is shown in Fig. 19. The following consideration will explain the action of air in an organ pipe:—By holding any tuning-fork to the mouth of a glass jar, or tube, of suitable length, it will be noticed that the sound is greatly increased. Now remove the tuning-fork, and, holding the tube to the lips, blow across its open mouth; a note will be produced which will be found to be exactly the same as that of the tuning-fork. The rush of the air across the open mouth causes a number of different pulses, of which the tube selects the one which is in most perfect accordance with itself, and increases its power. By taking different tubes, and blowing across them in this way, we shall find that in each case exactly the same note is produced as that uttered by a tuning-fork which resounds in unison with the tube.

By blowing more violently we shall obtain a note considerably above that first heard, and by blowing with still greater force we shall obtain notes successively higher and higher. If the number of vibrations corresponding to the fundamental note be represented by 1, we shall find that these *overtones*, as they are called, are represented by the odd numbers 3, 5, 7, etc. If, for instance, the fundamental note requires 100 vibrations in a second, the next note above it that can be obtained from the same pipe is produced by 300 vibrations in the same time. We cannot make the pipe utter any intermediate note, as, for instance, one with 200 or 250 vibrations.

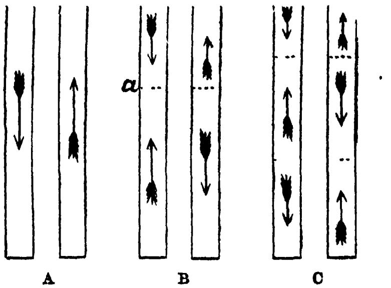

Fig. 20.

By examining the condition of the air inside the tube, we shall be able to understand the reason of this. We shall find that the bottom, or closed end, of the tube is always a node, while the mouth corresponds to a ventral segment.

When the fundamental note is sounded, the length of the sound-wave is just double that of the tube; the motion of the air in which is represented at A (Fig. 20), being merely a single pulse up and down.

Now, as we blow more violently, a node is formed in the tube, and since the mouth is a ventral segment, and the bottom a node, the second node must clearly be one-third of the way down the tube, as shown at *a*. The pulses in this case will be as represented in the above figure at B. The node *a* may indeed be considered as a thin layer of air remaining quite motionless, while the air between it and the next node, which in the case under consideration is the bottom of the tube, pulses alternately backward and forward.

A very good proof of this statement is afforded by placing an organ-pipe on a wind-chest, and procuring a small membrane stretched over a ring of such a size as to be capable of passing up and down the tube, which, for this experiment, should have a glass side. The membrane is then suspended horizontally by strings, and lowered down the tube. It will be seen that at some parts it is thrown into rapid vibration, while in other places it will be at rest. This will be rendered more manifest by sprinkling some fine sand on it before lowering it into the tube. By watching the place at which the vibrations cease, we shall find that it is just when the membrane is at one of the nodes, thus clearly showing that there the air is at rest.

When we blow more violently across the tube, two nodes will be produced, as seen at C; and in this case it is clear that the waves produced can only be one-fifth the length of those produced when the whole pipe sounds, as at A. The number of vibrations therefore is five times as great.

Thus far we have employed pipes closed at one end. If now we take others, similar in every other respect, but open at both ends, we shall find that the notes produced are just an octave higher—that is, an open tube yields a note an octave higher than a similar closed one of the same length The different notes produced by an open tube may be represented by the successive numbers, 1, 2, 3, 4, 5, etc. In all cases the extremities are ventral segments, and the nodes are distributed evenly between them.

We have now to see the way in which pipes are employed in musical instruments The common Pan pipe consists merely of a series of open tubes sounded by the mouth. In musical instruments, however, there is nearly always some special form given to the mouthpiece, which modulates to a greater or less extent the peculiar sound of the pipe. Fig. 21 shows the usual construction of the mouthpieces of the flageolet and of the organ-pipe. The end P of the latter is inserted in the wind-chest of the organ, whence the air issues into a cavity, *i*, which is frequently of larger dimensions than represented in the figure. As this issues from *i*, the current strikes against the upper lip *b*, and produces pulsations; these, by the resonance of the pipe, yield the required musical note, the pitch of which depends chiefly upon the length and size of the pipe.

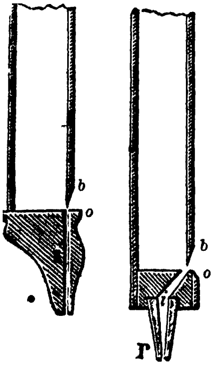

Fig. 21.

In an organ the same pipe always utters the same note, the different sounds being produced by a corresponding number of pipes. In other instruments—as, for example, the flute, trumpet, and cornet-à-piston—many notes may be produced from the same tube. This is accomplished partly by altering the position of the lips, or the intensity of the blast, and partly by altering the virtual length of the tubes by means of apertures or stops.

In the flute there are a number of openings, which are kept closed by the fingers. When any one of these is left unstopped, a ventral segment is produced in the tube at that point, and modifies the note. The vibrations in this instrument are produced by the current of air from the lips being directed over an aperture in the side of the tube.

In reed pipes the vibrations are more or less controlled by the vibration of the metal tongue. When the air issues from the wind-chest this tongue is set in vibration, and regulates the pulsations in the pipe.

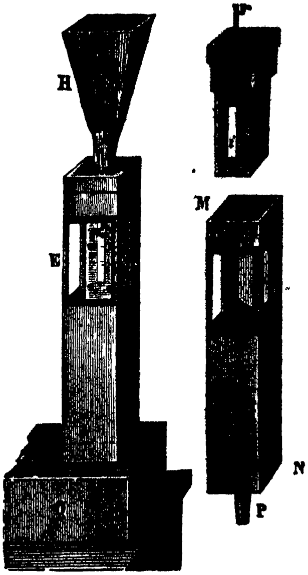

Fig. 22.

A pipe of this nature fitted with a piece of glass so as to exhibit the reed (which is a "free reed") is shown in Fig. 22. Q is the wind-chest of the bellows, into which P is fitted. In the right-hand figure the upper part of the pipe is removed, so as to show the reed more clearly. A plate of metal, *c c*, has a slit cut in it, in which the tongue *i* may just pass. When the air issues through the tube this tongue is thrown into vibration, and regulates the pulsations in the tube. By means of a curved wire, *r*, projecting above the top of the pipe, the play of the tongue may be controlled and the pipe tuned. The conical pipe, H, placed at the top, serves to increase the power of the sound.

The organ of voice is in reality a reed instrument of the most perfect construction. It is situated at the upper part of the windpipe, and contains elastic membranes against which the air is forced from the lungs, the membranes being thus put into a state of vibration. The laws for the vibrations of strings are not, however, followed by these so-called vocal chords, for no string so short could produce so low a note as those of the male voice. They do not follow the laws of a pipe, but approximate more closely to the conditions of a free reed. It is not necessary to refer further to this matter here, as there is a considerable doubt as to the exact action accompanying the production of certain notes by the human vocal organs.

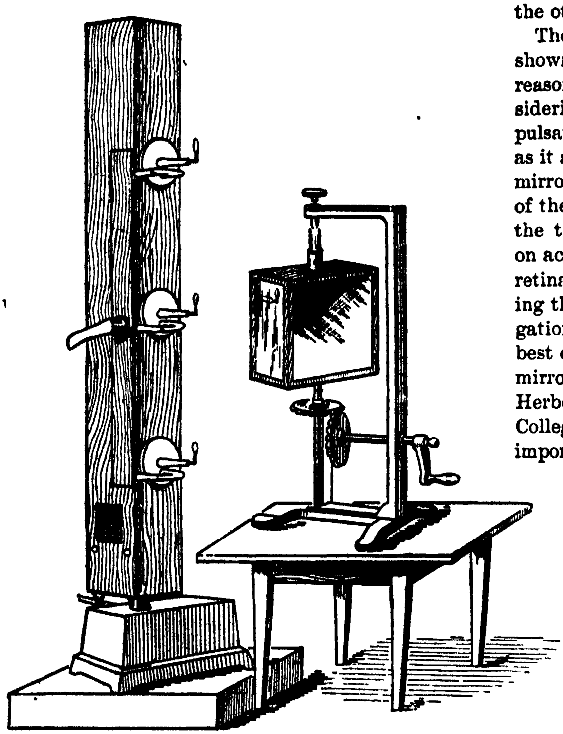

Fig. 23.

The indefatigable Dr. Koenig, of Paris, who has already been referred to, has constructed an apparatus by which *variations of pressure* due to the vibrations of a column of air in a pipe produce visible effects on burning gas-jets. Three small gas-jets are fixed at definite points in an organ-pipe, as shown in Fig. 23. The gas which supplies the jets is separated from the air in the pipe by a thin membrane, and when the pipe is made to "speak," the flame at a node is violently agitated, whilst that at a ventral segment is hardly affected; showing that there are much greater changes of *pressure* at the node, and that the air at a ventral segment is almost in the same condition as that outside. If the flame is reflected on to a revolving mirror, it presents the appearance of a serrated or wave-like band of light. The same mirror may be employed for two pipes giving, say, a note and its octave, and the serrations will be found to be twice as numerous in the one case as in the other.

The resulting image for a note and its octave are shown in Fig. 24. The reader will understand the reason of the production of such an image by considering that if the mirror remained at rest the pulsating flame would appear in the mirror simply as it appears when looked at directly. If now the mirror has a motion at right angles to the direction of the pulsations of the flame, the combination of the two shows a continuous serrated band of light on account of the persistence of impressions on the retina of the eye. Owing to the difficulty of rotating the mirror at a constant speed, delicate investigations involving important quantitative results are best carried out by a *vibrating* instead of a rotating mirror. Such has been adopted by Professor Herbert McLeod, of the Royal Indian Engineering College, Cooper's Hill, and Major Clarke, R.E., in important experiments on tuning-forks, the speed of machines, etc. These results—published in the Proceedings of the Royal Society for 1877 and elsewhere—have been, with great kindness, placed at our disposal by Professor McLeod, and may be briefly referred to. If space permit, the matter will be more fully dealt with later on.

It is evident that if the image of a point of light be observed in a vibrating mirror attached to a tuning-fork or reed, the image of the point in the mirror will appear as a straight line. If, however, the luminous point moves in a direction at right angles to the plane in which the mirror vibrates and parallel to the plane of the mirror, the two straight-line motions will produce a sinuous or wavy image; the dimensions of the waves depending on the amplitude of the vibrations of the fork, and on the rate of motion of the point of light in relation to the period of the fork. For instance, if equidistant points on a

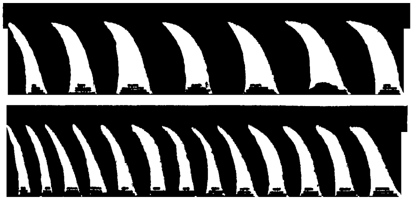

Fig. 24.

revolving disc are viewed in the mirror, and if the rate of the disc is such that the time occupied by a point in travelling over the distance between two consecutive points is equal to the time of one complete vibration of the fork, a continuous stationary image such as that shown at *a* Fig. 25, is seen, but if the point rotates at a slightly greater speed, the figure shows a slow progression in the direction of the moving circle. With higher speeds the other figures are produced, the figure being stationary so long as the time-rate of the point is an exact multiple of the period of the fork; if, however, there is a slight difference in the periods, the figure shows a progressive motion in one direction or the other, depending on whether the motion of the disc is too fast or too slow. This forms perhaps the most perfect method yet devised of determining the period of tuning-forks and other similar data.

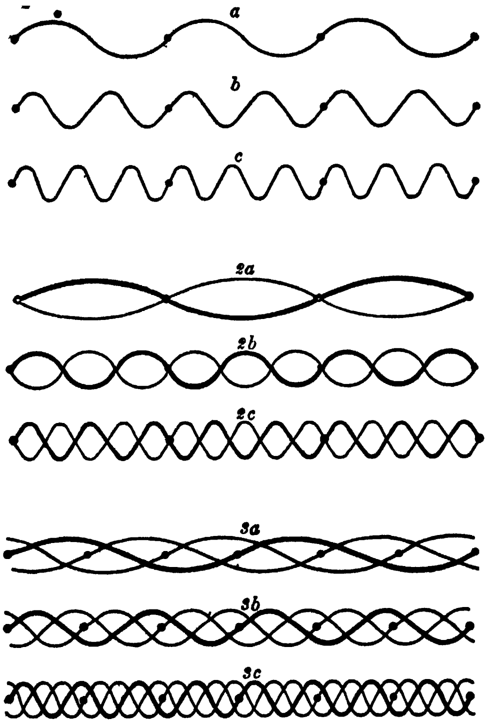

Fig. 25.

We have in this lesson dealt with various matters connected with the *production* of sounds mainly of a regular, or musical, character. In the next lesson we shall refer to certain facts and phenomena connected with the *propagation* of sound.

ELOCUTION.—XI.

[*Continued from p. 293.*]

PROMISCUOUS EXERCISES.

THE following specimen of *descriptive humour* requires the "lively movement" in its rate of utterance. The voice is, in this instance, *accelerated beyond the rate of serious communication* in any form, although it does *not* possess the *rapidity* which belongs to the excited style of lyric or dramatic poetry, in the most vivid style of humorous expression. This lesson combines, also, an exemplification of "moderate" force and "middle" pitch. The object in view in the practice of such exercises as this is to gain *animation* and *briskness* in utterance. A lagging or drawling tone is utterly incompatible with humorous delineation. *Mere rapidity*, however, will *not* succeed in imparting *liveliness* to style: the utterance must be *slow enough* to be *distinct*, and *spirited*.

XII. WOUTER VAN TWILLER.

The renowned Wouter (or Walter) van Twiller was descended from a long line of Dutch burgomasters, who had successively dozed away their lives and grown fat upon the bench of magistracy in Rotterdam, and who had comported themselves with such singular wisdom and propriety that they were never either heard or talked of—which, next to being universally applauded, should be the object of ambition of all ages, magistrates, and rulers.

His surname, Twiller, is said to be a corruption of the original *Twijfler*,* which, in English, means *Doubter*—a name admirably descriptive of his deliberative habits. For though he was a man shut up within himself, like an oyster, and of such a profoundly reflective turn that he scarcely ever spoke except in monosyllables, yet did he never make up his mind on any doubtful point. This was clearly accounted for by his adherents, who affirmed that he always conceived every object on so comprehensive a scale that he had not room in his head to turn it over, and examine both sides of it; so that he always remained in doubt, merely in consequence of the astonishing magnitude of his ideas!

There are two opposite ways by which some men get into notice—one by talking a vast deal and thinking a little, and the other by holding their tongues and not thinking at all. By the first, many a vapouring superficial pretender acquires the reputation of a man of quick parts; by the other, many a vacant dunderpate, like the owl, the stupidest of birds, comes to be complimented by a discerning world with all the attributes of wisdom. This, by the way, is a mere casual remark, which I would not for the universe have it thought I apply to Governor van Twiller. On the contrary, he was a very wise Dutchman, for he never said a foolish thing; and of such invincible gravity, that he was never known to laugh, or even to smile, through the course of a long and prosperous life. Certain, however, it is, there never was a matter proposed, however simple, and on which your common, narrow-minded mortals would rashly determine at the first glance, but what the renowned Wouter put on a mighty mysterious vacant kind of look, shook his capacious head, and having smoked for four or five minutes with redoubled earnestness, sagely observed that "he had his doubts about the matter"—which in process of time gained him the character of a man slow in belief, and not easily imposed on.

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* Pronounced *Tweefler.*

The person of this illustrious old gentleman was as regularly formed and nobly proportioned as though it had been moulded by the hands of some cunning Dutch statuary, as a model of majesty and lordly grandeur. He was exactly five feet six inches in height, and six feet five inches in circumference. His head was a perfect sphere, and of such stupendous dimensions that dame Nature, with all her sex's ingenuity, would have been puzzled to construct a neck capable of supporting it; wherefore she wisely declined the attempt, and settled it firmly on the top of his backbone, just between the shoulders. His body was of an oblong form, particularly capacious at bottom; which was wisely ordered by Providence, seeing that he was a man of sedentary habits, and very averse to the idle labour of walking. His legs, though exceeding short, were sturdy in proportion to the weight they had to sustain; so that, when erect, he had not a little the appearance of a robustious beer-barrel standing on skids. His face, that infallible index of the mind, presented a vast expanse, perfectly unfurrowed or deformed by any of those lines and angles which disfigure the human countenance with what is termed expression. Two small grey eyes twinkled feebly in the midst, like two stars of lesser magnitude in the hazy firmament; and his full-fed cheeks, which seemed to have taken toll of everything that went into his mouth, were curiously mottled and streaked with dusky red, like a Spitzenberg apple.

His habits were as regular as his person. He daily took his four stated meals, appropriating exactly an hour to each, he smoked and doubted eight hours, and he slept the remaining twelve of the four-and-twenty. Such was the renowned Wouter van Twiller—a true philosopher; for his mind was either elevated above or tranquilly settled below the cares and perplexities of this world. He had lived in it for years without feeling the least curiosity to know whether the sun revolved round it, or it round the sun; and he had watched for at least half a century the smoke curling from his pipe to the ceiling, without once troubling his head with any of those numerous theories by which the philosopher would have perplexed his brain, in accounting for its rising above the surrounding atmosphere.—*Washington Irving.*

XIII. THE CHILD OF THE TOMB: A STORY OF NEW BURYPORT.

[The following fact is found in Knapp's "Life of Lord Dexter."]

Where WHITEFIELD sleeps, remembered, in the dust,
The lowly vault held once a double trust,
And PARSONS, reverend name, that quiet tomb
Possessed,—to wait the day of weal and doom.
Another servant of the living God,
PRINCE, who (bereft of sight) his way had trod,
Unerringly and safe, life's journey through,
Now sought admittance to these slumberers too.
As earth receded, and the mansions blest
Rose on his vision,—"Let my body rest
With Whitefield's"—said he, yielding up his breath,
In life beloved, and not disjoined in death.
Obedient to his wish, in order then
Were all things done; the tomb was oped to ken
Of curious eyes,—made ready to enclose
Another tenant in its hushed repose:
And, lighted with a single lamp, whose ray
Fell dimly down upon the mouldering clay,
Was left, prepared, to silence as of night,
Till hour appointed for the funeral rite.
It chanced the plodding teacher of a school,—
A man of whim, bold, reckless, yet no fool,—
Deemed this an opportunity to test
How far the fears of spirits might infest
The bosom of a child. A "likely" boy,
The choicest of his flock, a mother's joy,
He took, unscrupulous of means, if he
His ends might gain, and solve the mystery.

Both stood within the mansion of the dead,
And while the stripling mused, the teacher fled,
Leaving the child, where the dull cresset shone,
With the dumb relics and his God alone.
As the trap-door fell suddenly, the stroke,
Sullen and harsh, his solemn reverie broke.
Where is he?—Barred within the dreadful womb
Of the cold earth—the living in the tomb!
The opened coffins showed Death's doings, sad,—
The awful dust in damps and grave-mould clad,
Though near the haunt of busy, cheerful day,
He, to drear night and solitude the prey!
Must he be watcher with these corpses!—Who
Can tell what sights may rise? Will reason then be true?
Must he,—a blooming, laughter-loving child,—
Be mated thus?—The thought was cruel, wild!
His knees together smote, as first, in fear,
He gazed around his prison,—then a tear
Sprang to his eyes in kind relief, and said
The little boy, "*I will not be afraid*
Was ever spirit of the good man known
To injure children whom it found alone?"
And straight he taxed his memory, to supply
Stories and texts, to show he *might* rely
Most safely, humbly, on his Father's care,
Who hears a child's as well as prelate's prayer
And thus he stood,—on Whitefield's form his glance
In reverence fixed,—and hoped deliverance

Meanwhile, the recreant teacher,—where was he?
Gone in effrontery to take his tea
With the lad's mother!—Supper done, he told
The feat that should display her son as bold.
With eye indignant, and with words of flame,
How showers that mother's scorn, rebuke, and shame,
And bids him haste! and hastes herself, to bring
Him from Death's realm, who knew not yet its sting:
And yet believed,—so well her son she knew,—
The noble boy would to himself be true:
He would sustain himself, and she would find
Him patient and possessed, she trusted well his mind.
The boy yet lives, and from that distant hour
Dates much of truth that on his heart hath power;
And chiefly this,—whate'er of wit is wed
To word of his,—*to reverence the dead*

XIV. FOUNDATION OF NATIONAL CHARACTER.

[To be marked for *inflections* by the student.]

Mental energy has been equally diffused by sterner levellers than ever marched in the van of a revolution, the nature of man and the providence of God. Native character, strength, and quickness of mind are not of the number of distinctions and accomplishments that human institutions can monopolise within a city's walls. In quiet times they remain and perish in the obscurity to which a false organisation of society consigns them. In dangerous, convulsed, and trying times, they spring up in the fields, in the village hamlets, and on the mountain tops, and teach the surprised favourites of human law, that bright eyes, skilful hands, quick perceptions, firm purpose, and brave hearts, are not the exclusive appanage of courts.

Our popular institutions are favourable to intellectual improvement, because their foundation is in dear nature. They do not consign the greater portion of the social frame to torpidity and mortification They send out a vital nerve to every member of the community, by which its talent and power, great or small, are brought into living conjunction and strong sympathy with the kindred intellect of the nation ; and every impression on every part vibrates, with electric rapidity, through the whole. They encourage nature to perfect her work ; they make education, the soul's nutriment, cheap ; they bring up remote and shrinking talent into the cheerful field of competition in a thousand ways they provide an audience for lips which nature has touched with persuasion ; they put a lyre into the hands of genius ; they bestow on all who deserve it, or seek it, the only patronage worth having, the only patronage that ever struck out a spark of "celestial fire,"—the patronage of fair opportunity.

This is a day of improved education , new systems of teaching are devised , modes of instruction, choice of studies, adaptation of text-books, the whole machinery of means, have been brought, in our day, under severe revision But were I to attempt to point out the most efficacious and comprehensive improvement in education—the engine by which the greatest portion of mind could be brought and kept under cultivation, the discipline which would reach furthest, sink deepest, and cause the word of instruction not to spread over the surface, like an artificial hue, carefully laid on, but to penetrate to the heart and soul of its objects—it would be popular institutions Give the people an object in promoting education, and the best methods will infallibly be suggested by that instinctive ingenuity of our nature, which provides means of great and precious ends. Give the people an object in promoting education, and the worn hand of labour will be opened to the last farthing, that its children may enjoy means denied to itself—*E. Everett.*

[To be marked for *Inflections* by the student]

XV CAUSES OF WAR

What are sufficient causes of war let no man say let no legislator say, until the question of war is directly and inevitably before him. Jurists may be permitted with comparative safety, to pile tome upon tome of interminable disquisition upon the motives, reasons, and causes of just and unjust war Metaphysicians may be suffered with impunity to spin the thread of their speculations until it is attenuated to a cobweb , but for a body created for the government of a great nation, and for the adjustment and protection of its infinitely diversified interests, it is worse than folly to speculate upon the causes of war until the great question shall be presented for immediate action—until they shall hold the united question of cause, motive, and present expediency, in the very palm of their hands War is a tremendous evil. Come when it will, unless it shall come in the necessary defence of our national security or of that honour under whose protection national security reposes, it will come too soon—too soon for our national prosperity—too soon for our individual happiness—too soon for the frugal, industrious, and virtuous habits of our citizens—too soon, perhaps, for our most precious institutions. The man who, for any cause, save the sacred cause of public security, which makes all wars defensive—the man who, for any cause but this, shall promote or compel this final and terrible resort, assumes a responsibility second to none, nay, transcendently deeper and higher than any which man can assume before his fellow-man, or in the presence of God, his Creator.—*Binney.*

XVI. A CHILD CARRIED AWAY BY AN EAGLE.

The great golden eagle, the pride and the pest of the parish, swooped down, and flew away with something in his talons One single sudden female shriek, and then shouts and outcries, as if a church spire had tumbled down on a congregation at a sacrament ! "Hannah Lamond's bairn ! Hannah Lamond's bairn !" was the loud, fast-spreading cry. "The eagle's ta'en off Hannah Lamond's bairn !" and many hundred feet were in another instant hurrying towards the mountain. Two miles of hill and dale, and copse and shingle, and many intersecting brooks lay between ; but in an incredibly short time the foot of the mountain was alive with people.

The eyrie was well known, and both old birds were visible on the rock-ledge. But who shall scale that dizzy cliff, which Mark Steuart, the sailor, who had been at the storming of many a fort, attempted in vain? All kept gazing, weeping, wringing of hands in vain, rooted to the ground, or running backwards and forwards, like so many ants essaying their new wings in discomfiture. "What's the use—what's the use o' ony puir human means? We have no power but in prayer !" and many knelt down—fathers and mothers thinking of their own babies—as if they would force the deaf heavens to hear!

Hannah Lamond had all this while been sitting on a rock, with a face perfectly white, and eyes like those of a mad person fixed on the eyrie Nobody had noticed her ; for strong as all sympathies with her had been at the swoop of the eagle, they were now swallowed up in the agony of eyesight. "Only last Sabbath was my sweet wee wean baptised, in the name o' the Father, and the Son, and the Holy Ghost !" and, on uttering these words, she flew off through the brakes and over the huge stones, up—up—up, faster than ever huntsman ran in to the death, fearless as a goat playing among the precipices.

No one doubted, no one could doubt, that she would soon be dashed to pieces But have not people who walk in their sleep, obedient to the mysterious guidance of dreams, climbed the walls of old ruins, and found footing, even in decrepitude, along the edge of unguarded battlements, and down dilapidated staircases, deep as draw-wells, or coal-pits, and returned with open, fixed, and unseeing eyes, unharmed to their beds, at midnight? It is all the work of the soul, to whom the body is a slave, and shall not the agony of a mother's passion, who sees her baby, whose warm mouth has just left her breast, hurried off by a demon to a hideous death, bear her limbs aloft wherever there is dust to dust, till she reach that devouring den, and, fiercer and more furious far, in the passion of love, than any bird of prey that ever bathed its beak in blood, throttle the fiends that with their heavy wings would fain flap her down the cliffs, and hold up the child, in deliverance, before the eye of the all-seeing God?

No stop—no stay ; she knew not that she drew her breath. Beneath her feet Providence fastened every loose stone, and to her hand strengthened every root. How was she ever to descend? That fear, then, but once crossed her heart as she went—up—up—up, to the little image made of her own flesh and blood "The God who holds me now from perishing, will not the same God save me when my child is on my bosom?" Down came the fierce rushing of the eagles' wings—each savage bird dashing close to her head, so that she saw the yellow of their wrathful eyes. All at once they quailed and were cowed. Yelling, they flew off to the stump of an ash jutting out of the cliff, a thousand feet above the cataract ; and the Christian mother falling across the eyrie, in the midst of bones and blood, clasping her child—dead, dead, dead, no doubt—but unmangled and untorn, and swaddled up, just as it was when she laid it down asleep among the fresh hay, in a nook of the harvest field.

Oh ! what a pang of perfect blessedness transfixed her heart from that faint, feeble cry "It lives—it lives—it lives !" and baring her bosom, with loud laughter, and eyes dry as stones, she felt the lips of the unconscious innocent once more murmuring at the fount of life and love ! "O

Thou great and Thou dreadful God! whither hast Thou brought me, one of the most sinful of Thy creatures? Oh! save my soul, lest it perish, even for Thy Own name's sake! O Thou, Who diedst to save sinners, have mercy upon me."

Cliffs, chasms, blocks of stone, and the skeletons of old trees—far, far down, and dwindled into specks—a thousand creatures of her own kind, stationary, or running to and fro! Was that the sound of the waterfall or the faint roar of voices? Is that her native strath?—and that tuft of trees does it contain the hut in which stands the cradle of her child? Never more shall it be rocked by her foot! Here she must die—and, when her breast is exhausted, her baby too! And those horrid beaks, and eyes, and talons, and wings will return; and her child will be devoured at last, even within the dead bosom that can protect it no longer.

Where, all this while, was Mark Steuart, the sailor? Half way up the cliffs. But his eye had got dim, and his head dizzy, and his heart sick; and he who had so often reefed the top-gallant sail, when at midnight the coming of the gale was heard afar, covered his face with his hands, and dared look no longer on the swimming heights.

"And who will take care of my poor bedridden mother?" thought Hannah, whose soul, through the exhaustion of so many passions, could no more retain in its grasp that hope which it had clutched in despair. A voice whispered, "God!" She looked around, expecting to see an angel; but nothing moved except a rotten branch, that, under its own weight, broke off from the crumbling rock. Her eye, by some secret sympathy of her soul with the inanimate object, watched its fall, and it seemed to stop not far off, on a small platform.

Her child was bound within her bosom—she remembered not how or when—but it was safe; and scarcely daring to open her eyes, she slid down the shelving rocks, and found herself on a small piece of firm root-bound soil, with the tops of bushes appearing below. With fingers suddenly strengthened into the power of iron, she swung herself down by brier, and broom, and heather, and dwarf-birch. There a loosened stone leapt over a ledge; and no sound was heard, so profound was its fall. There the shingle rattled down the screes, and she hesitated not to follow. Her feet bounded against the huge stone that stopped them, but she felt no pain. Her body was callous as the cliff.

Steep as the wall of a house was now the side of the precipice. But it was matted with ivy centuries old, long ago dead, and without a single green leaf, but with thousands of arm-thick stems, petrified into the rock, and covering it as with a trellis. She bound her baby to her neck, and with hands and feet clung to that fearful ladder. Turning round her head and looking down, lo, the whole population of the parish, so great was the multitude, on their knees! and hush; the voice of psalms! a hymn breathing the spirit of one united prayer! Sad and solemn was the strain, but nothing dirge-like—breathing not of death but deliverance. Often had she sung that tune—perhaps the very words, but them she heard not—in her own hut, she and her mother, or in the kirk, along with all the congregation. An unseen hand seemed fastening her fingers to the ribs of ivy; and in sudden inspiration, believing that her life was to be saved, she became almost as fearless as if she had been changed into a winged creature.

Again her feet touched stones and earth. The psalm was hushed, but a tremulous sobbing voice was close beside her, and lo! a she-goat with two little kids at her feet. "Wild heights," thought she, "do these creatures climb; but the dam will lead down her kid by the easiest paths, for oh! even in the brute creatures, what is the holy power of a mother's love!" and turning round her head, she kissed her sleeping baby, and for the first time she wept.

Overhead frowned the front of the precipice, never touched before by human hand or foot. No one had ever dreamt of scaling it; and the golden eagles knew that well in their instinct, as, before they built their eyrie, they had brushed it with their wings. But all the rest of this part of the mountain-side, though scarred, and seamed, and chasmed, was yet accessible; and more than one person in the parish had reached the bottom of the Glead's Cliff. Many were now attempting it; and ere the cautious mother had followed her dumb guides a hundred yards, though among dangers that, although enough to terrify the stoutest heart, were traversed by her without a shudder, the head of one man appeared, and then the head of another; and she knew that God had delivered her and her child in safety into the care of their fellow-creatures.

Not a word was spoken—eyes said enough; she hushed her friends with her hands, and with uplifted eyes, pointed to the guides sent to her by heaven. Small green plats, where those creatures nibble the wild flowers, became now more frequent; trodden lines, almost as easy as sheep-paths, showed that the dam had not led her young into danger; and now the brushwood dwindled away into straggling shrubs, and the party stood on a little eminence above the stream, and forming part of the strath.

There had been trouble and agitation, much sobbing and many tears among the multitude, while the mother was scaling the cliffs: sublime was the shout that echoed afar the moment she reached the eyrie; then had succeeded a silence deep as death. In a little while arose the hymning prayer, succeeded by mute supplication; the wildness of thankful and congratulatory joy had next its sway; and now that her salvation was sure, the great crowd rustled like the wind-swept wood. And for whose sake was all this alternation of agony? A poor humble creature unknown to many even by name—one who had but few friends, nor wished for more, contented to work all day—here, there, anywhere—that she might be able to support her aged mother and her little child; and who on Sabbath took her seat in an obscure pew, set apart for paupers, in the kirk.—*Professor Wilson.*

SPANISH.—II.

[*Continued from p.* 313.]

THE ADJECTIVE.

ADJECTIVES in Spanish have both a singular and a plural form, according as they are used with singular or plural nouns; for example:—

Grande hombre, *tall man.* Grandes hombres, *tall men.*

The rules for the formation of the plural of adjectives are the same as those for forming the plural of nouns.

Adjectives which end in *an*, *on*, or *o*, and such as are derived from the names of nations, change not only from the singular to the plural, but also from the masculine to the feminine, to agree with the noun (expressed or understood) to which they belong; as,

Español, *Spanish (man)*; Española, *Spanish (woman).*
Hombre generoso, *generous man*; muger generosa, *generous woman.*
Fanfarron, *bragging (man)*; fanfarrona, *bragging (woman).*
Ingles, *English (man)*; Inglesa, *English (woman).*

From the examples just given, it will be seen that adjectives ending with *o*, change *o* into *a* to form the feminine; and that those ending with *an* or *on*, as well as those derived from the names of nations, form their feminine by adding *a* to the masculine.

In forming the plural of adjectives which are modified by gender, the gender must be taken into consideration first, and then the plural ending added; as,

La tímida vaca, *the timid cow.*	Las tímidas vacas, *the timid cows.*
El manso caballo, *the tame horse.*	Los mansos caballos, *the tame horses.*
El Ingles, *the English (man).*	Los Ingleses, *the English (men).*
La Inglesa, *the English (woman).*	Las Inglesas, *the English (women.)*

Adjectives in Spanish are as a rule placed after the nouns which they qualify, though some generally come before the noun; and some can precede or follow the noun, according to the taste of the writer or speaker. Thus,

> Un hombre respetable, *a respectable man.*
> Una felicidad aparente, *an apparent felicity.*
> Malas obras, *or* obras malas, *bad works.*

Some adjectives and adjective pronouns drop the final *o* in the masculine singular (but not in the plural), when they are placed before the noun, but never when they are placed after it. These are uno, *a* (or *one*); alguno, *some;* ninguno, *none;* primero, *first;* postrero, *last;* tercero, *third;* bueno, *good;* malo, *bad;* as,

> Algun fruto, *some fruit.*
> Un buen hombre, *or* un hombre bueno, *a good man.*

Santo, *saint*, when prefixed to the name of a male person, drops its last syllable; as, San Pedro, *St. Peter*. Ciento, *hundred*, when it *immediately* precedes a noun, masculine or feminine, drops its final syllable; as, cien árboles, *hundred trees;* but, ciento y dos árboles, *hundred and two trees.* Grande, *great, large*, generally loses its final syllable when the noun to which it is prefixed begins with a consonant; as, gran poder, *great power.* When *grande* does not mean size or magnitude, but good qualities, *gran* is used if the noun follow it Thus, gran hombre means, *a great man;* and grande hombre, *a tall man.*

Adjectives are often used without the noun (the latter being understood); as,

> El pobre, *the poor (man).* Un ignorante, *an ignorant (man).*

The gender can be known by the article which precedes the adjective.

If the adjective refer to something to which we do not apply a gender, the neuter article *lo* is used; as, lo poco, lo mucho, *the little, the much,* or *that which is little, that which is much.*

In cases in which the position of adjectives would present any difficulty to the learner, the order of the words will be numbered, thus: los hombres^2 magnánimos^1 son bienhecheros del género^2 humano^1, *magnanimous men are benefactors of the human race.* The order in which English words must be placed in Spanish will be indicated in the same manner when deemed necessary.

A sentence is rendered negative in Spanish by placing the adverb *no* (not) before the verb; as, Juan *no* es sábio, *John is* not *wise;* Pedro *no* tiene dinero, *Peter has* no *money;* Maria *no* tiene sed, *Mary is* not *thirsty.*

VOCABULARY.

Amigo, *friend.*
Bueno, *good*
Camino, *road, way.*
Dos, *two.*
É, *and* (before *i*).
Ejército, *army.*
El Español ama, *the Spaniard loves.*
Es, *is.*
Espacioso, *spacious, wide.*
Español, *Spanish*
Estrecho, *narrow, close.*
Falaz, *false, deceitful.*
Frances. *French.*
Fuerte, *strong.*
General, *general.*
Grande, *great.*
Hermosa, *beautiful, handsome*
Ignorante, *ignorant.*
Impío, *wicked, impious.*
Ingles, *English*
Lengua, *language, tongue.*
Lindo, *pretty.*
Los Españoles aman, *the Spaniards love.*
Malo, *bad, evil.*
Nuevo, *new.*
Pobre, *poor.*
Rico, *rich.*
Robusto, *robust.*
Sábio, *wise*
Sobérbio, *proud.*
Son, *are.*
Tenebroso, *gloomy, dark.*
Tres, *three.*
Verdad, *truth.*
Viejo, *old.*
Y, *and.*

Y is used for the conjunction *and*, except before words beginning with *i* or *hi*, when *é* is used.

EXERCISE 5.

Translate into English.—

1. El camino es estrecho. 2. La casa es espaciosa. 3. Las mugeres son sobérbias. 4. Los Ingleses no tienen dinero. 5. Las Inglesas no tienen hambre. 6. Los Españoles no tienen sed. 7. Las Americanas son hermosas. 8. Los libros son nuevos. 9. Un buen general es el alma de un ejército. 10. El Frances es pobre y sobérbio. 11. El amigo del médico es ignorante. 12. El juez es sábio y rico. 13. La léngua^2 falaz^1 no ama la verdad 14 Los Americanos aman dinero. 15. Los hijos del pintor son fuertes y robustos. 16. Los pobres tienen hambre.

EXERCISE 6.

Translate into Spanish:—

1. The Frenchman wrote letters to the Spanish woman. 2. The Americans are friends of the English (*Ingleses*). 3. The way of the wicked is dark. 4 The daughters of the Spaniard (*Español*) are pretty. 5. The books are new. 6. The house of the physician is spacious. 7. The horses of the Englishman are strong. 8. The sons of the judge are poor and proud. 9. The daughter of the Frenchwoman is proud and ignorant. 10. The sisters of the painter are rich and handsome. 11. A good man loves the truth. 12. A false^2 tongue^1 loves not the truth. 13. The Spaniards and the Americans love money. 14. The silver spoons (*cucharas de plata*) are new. 15. The road is narrow. 16. The judge's son is bad and ignorant. 17. The printers are rich. 18. The physician's male servant is robust.

In Spanish proper names employed as adjectives are not generally written with a capital initial letter; thus we write, libros españoles, *Spanish books;* and not *libros Españoles.*

DEGREES OF COMPARISON.

When two things are compared, the one is equal, inferior, or superior to the other. Hence there are three sorts of comparison; that of *equality*, *inferiority*, and *superiority*. Thus we may say, John is *as happy as* James; John is *less happy than* James; or, John is *more happy than* James. These adjectives are all properly in the comparative degree.

The *comparative of equality* is formed by placing *tan* (as, so) before the adjective, and *como* (as) after it; as,

El Judío es *tan rico como* el Frances.	*The Jew is* as rich *as the Frenchman.*

Sometimes *tan* is omitted, and *como* only used; as,

Juan es fuerte como un leon.	*John is strong as a lion.*

Cual (qual) is sometimes found instead of *como*. *Tan* used before an adjective, without *como*, means *so;* as, tan grande, *so great.*

The *comparative of inferiority* is formed by placing *ménos* (less) before, and *que* (than) after the adjective; as,

El Judío es *ménos rico que* el Frances.	*The Jew is* less rich than *the Frenchman.*

The *comparative of superiority* is formed by placing *mas* (more) before, and *que* (than) after the adjective; as,

Mi madre es *mas rica que* la reina.	*My mother is* more rich (*richer*) than *the queen.*

Mayor, *greater;* mejor, *better;* and menor, *less*, are already in the comparative degree, and do not require *mas* before them; as,

Los reyes son *mayores que* los lores,	*The kings are* greater than *the lords.*

The superlative degree of the adjective expresses the quality in a *very high* or *very low*, or in the *highest* or *lowest* state. Hence there are two sorts of superlatives, the *absolute* and the *relative*. Thus we may say, London is a *very large* city; or, London is the *largest city* in England.

The *superlative absolute* is formed either by placing *muy* (very) before the adjective, or by affixing the letters *-ísimo* to the simple form of the adjective; as,

Útil, *useful;* muy útil, *or* utilísimo, *very useful*, or *most useful.*

If the adjective ends with a vowel, this vowel is dropped when *-ísimo* is affixed; as, grande, *great;* grandísimo, *or* muy grande, *very great;* alto, *high;* altísimo, *or* muy alto.

Adjectives that end with *-ble*, *-co*, *-go*, and z, change these letters respectively into *bil*, *qu*, *gu*, and *c*, before the suffix *-ísimo;* as, noble, *noble;* nobilísimo, *very noble;* seco, *dry;* sequísimo, *very dry;* largo, *large;* larguísimo, *very large;* feraz, *fruitful;* feracísimo, *very fruitful;* or, muy noble, muy seco, muy largo, muy feraz.

Most adjectives may have their superlatives formed by *muy* prefixed, or by the ending *-ísimo*. There are a few, however, such as those ending with *-ial* and antepenults (*i.e.* those accented on the last syllable but two) ending with *-co*, *-go*, *-lo*, which form their superlative absolute always with *muy;* as, social, *social;* muy social (and not socialísimo), *very social.* As a general rule, adjectives of many syllables form their superlative absolute by *muy* and not with *-ísimo*. The superlative of mucho, *much*, is always muchísimo.

The superlative relative is formed by placing the definite article before mas (*more*) or ménos (*less*), and putting these before the adjective; as—

El Judío es *el mas rico* de todos,	*The Jew is* the most rich (*the richest*) *of all.*

Remark.—Some of the adjectives have, besides the regular superlative absolute, also an irregular one, derived from some ancient form of the adjective; as, fidelísimo, *very faithful;* bonísimo, *very good.* The regular superlative of these adjectives is fielísimo and buenísimo, from fiel, *faithful*, and bueno, *good.*

VOCABULARY.

Aleman, *German.*
Amable, *amiable.*
Alto, *high, lofty.*
Armonioso, *harmonious.*
Bello, *fine, elegant.*
Benigno, *benign.*
Béstia, *beast.*
Brilliante, *brilliant.*
Culpable, *culpable.*
El médico halló, *the doctor found.*
En, *in, on.*
Escrupuloso, *scrupulous.*
Estrella, *star*
Gárrulo, *garrulous, talkative.*
Génio, *genius, disposition.*
Leon, *lion.*
Los médicos hallaron, *the doctors found*
Luna, *moon.*
Monte, *mountain.*
Planeta (masc.), *planet.*
Prudéncia, *prudence.*
Sol, *sun.*
Sombrero, *hat.*
Tesoro, *treasure.*
Todo, *every, all.*
Torre (fem.), *tower.*
Viejo, *old.*

EXERCISE 7.

Translate into English:—

1. La muger es muy amable. 2. El juez es muy viejo. 3. El criado es muy culpable. 4. La léngua española es bella e muy armoniosa. 5. La luna es muy brilliante. 6. Las estrellas son muy brilliantes. 7. Las torres son altísimas. 8. Las Españoles son muy sobérbias. 9. El juez es muy escrupuloso. 10. La casa es altísima. 11. El buey es tan fuerte como el caballo. 12. El pintor es mas robusto que el impresor. 13. Las criadas de la Española son mas gárrulas que los criados del Alèman. 14. El sol es mas brilliante que la luna. 15. La luna es ménos brilliante que el sol. 16. La hija del médico es ménos hermosa que la hija del juez. 17. Las casas no son tan altas como las torres.

EXERCISE 8.

Translate into Spanish:—

1. The mountain is very high. 2. The male servant is very old. 3. The Spanish[2] language[1] is elegant and very harmonious. 4. The sun is most brilliant. 5. The stars are very brilliant. 6. The painter is as proud as the judge. 7. The horse is as strong as the ox. 8. The carpenter is as rich as the printer. 9. The daughters of the German woman are less culpable than the daughters of the Spanish woman. 10. The stars are less brilliant than the moon. 11. The lion is stronger than the horse. 12. The judge is wiser than the physician.

PERSONAL PRONOUNS.

The personal pronouns are—yo, *I;* tú, *thou;* usted, *you;* él, ella, ello, *he, she, it;* nosotros (masc), nosotras (fem.), *we;* vosotros (masc.), vosotras (fem), *ye;* ustedes, *you;* ellos (masc), ellas (fem.), *they;* se, *himself.*

Nos is sometimes used in the nominative for *nosotros;* as, we (*nos*) the representatives of Mexico

Vos is used only in addressing the Deity or persons of very superior rank.

Usted is the only word with which persons address and are addressed in ordinary conversation in Spanish. It is a contraction of vuestra merced (*your worship*); and though it is always to be translated by the second person (*you*) in English, it is, of course, of the third person, and requires its corresponding possessive pronoun and the verb to which it may be the nominative to be in the third person. In writing, *usted* is nearly always abbreviated into *v*, *vm.*, *vmd.*, *vd.*, *V.*, *Vm.*, *VM.*, *Vtra*, or *Md.;* and the plural (*ustedes*) into *vs.*, *vms.*, *vmds*, *VV.*, *Vms.*, *Vmds.* *V.* for the singular and *VV.* for the plural are the forms ordinarily used.

The personal pronouns have two forms of the objective case, the *direct* and the *indirect*, the first governed by the verb or the preposition *to* (*understood*), and the second always governed by a preposition before it (*expressed*); as—

1st Juan *me* dió un libro, *John* (*to*) me *gave a book.*
2nd. Juan vino por *mí.* *John came for* me.

The personal pronouns* are declined as follows:—

FIRST PERSON.

	Singular.	*Plural.*
Nom.	Yo, *I.*	Nosotros, -as, *we.*
1st Obj.	Me, *me, to me*	Nos, *us, to us.*
2nd Obj.	Á mí, *to me.*	Á nosotros, -as, *to us.*

SECOND PERSON.

Nom.	Tú, *thou.*	Vosotros, -as, *you.*
1st Obj.	Te, *thee, to thee.*	Os, *you, to you.*
2nd Obj.	Á ti, *to thee.*	Á vosotros, -as, *to you.*

THIRD PERSON MASCULINE.

Nom.	Él, *he.*	Ellos, *they.*
1st Obj.	Le, *him, to him.*	Los, *them;* les, *to them.*
2nd Obj.	Á él, *to him.*	Á ellos, *to them.*

THIRD PERSON FEMININE.

Nom.	Ella, *she.*	Ellas, *they.*
1st Obj.	La, *her;* le, *to her.*	Las, *them;* les, *to them.*
2nd Obj.	Á ella, *to her.*	Á ellas, *to them.*

THIRD PERSON FOR INDEFINITE OBJECTS.

Nom.	Ello, *it.*	
1st Obj.	Lo, *it.*	(Wanting in the Plural.)
2nd Obj.	Á ello, *to it.*	

THIRD PERSON IN ADDRESSING.

Nom.	Usted, *your worship, you.*	Ustedes, *your worships, you*
1st Obj.	Le, *your worship, to you.*	Les, *your worships, to you.*
2nd Obj.	Á usted, *to your worship, to you.*	Á ustedes, *to your worships, to you.*

THIRD PERSON REFLECTIVE.

1st Obj.	Se, *himself, herself, itself; themselves.*
2nd Obj.	Á sí, *to himself, to herself, to itself, to themselves.*

A pronoun of the first objective case is placed before the verb which governs it, except with infinitives, imperatives, and gerunds; as—

El hombre *me* dijo, *the man said* to me. Los perros *los* seguieron, *the dogs followed* them.

If the sentence begins with a verb, the pronoun is allowed to come after it; in other words, a pronoun of the first objective case may or may not *begin* a sentence. When the pronoun comes after the verb, it is joined to it, and both form one word; as—

Negó*les* el cielo este *gozo.* *Denied*-them *heaven this pleasure.*

The first objective case is employed in Spanish when in English either the verb or the preposition *to*, expressed or understood, governs the personal pronouns; as—

Pablo *me* mandó, *Paul commanded* me. Juan *te* dió un libro, *John gave* (*to*) thee *a book.*

When in English the personal pronouns of the *third person* are governed by the verb, in Spanish *le* and *los* for the masculine, and *la*, *las*, for the feminine, are used; as—

La muger *le* vió, *the woman saw* him. El viajante *los* halló, *the traveller found* them.

When in English the personal pronouns of the *third person* are governed by the preposition *to*, expressed or understood, in Spanish *le* and *les* are used for both genders; as—

El juez *le* dijo, *the judge said* to-him (*or* to-her). Los libreros *les* dieron libros, *the booksellers gave* (to) them *books.*

The second objective is always used after comparatives; as—

Te quiero mas que *á el.* *I love thee more than* him.

A personal pronoun of the second objective case is placed after a preposition; as—

Cayó temor *sobre él, fear fell* upon him. El pintor lo hizo *para mí, the painter made it* for me.

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* We have here used only the preposition *á* before the indirect or second objective, though any other preposition would require the same case; as, *de él, por ellos, para mí.*

If in English two objective cases of personal pronouns are in the same sentence, one of them governed by the preposition *to*, understood, and the other by a verb, the one governed by the preposition is placed first in Spanish; as—

María *me* lo dió, *Mary* (*to*) me *it gave* (or, *Mary gave it* to me).

Pedro *les* le llevó, *Peter* (*to*) them *her brought* (or, *brought her* to them).

If the pronoun be reflective—that is, if the nominative and objective cases refer to the same person—the reflective pronoun must come before the other, if another be used in the same sentence; as—

El cura *se* me dirigió, *The rector addressed* himself *to me.*

When in the second objective case any one of the pronouns *mí*, *tí*, *sí*, is preceded by the preposition *con* (with), this preposition is prefixed to the pronoun, and the syllable *go* affixed, the whole forming one word; as—

Juan vino *conmigo*, *John came* with-me.

Ella vino *contigo*, *she came* with-thee.

The first objective case of the personal pronouns comes after *infinitives*, *imperatives*, and *gerunds* * of the verb, forming one word with the verb; as—

Da*nos* dinero, *give*-us *money.*

Haga*me* V. una casaca, *make*-me, *your worship, a coat.*

Entonces Pedro tomando*le* aparte, comenzo á reñir*le*, *then Peter, taking*-him *apart, began to chide*-him.

When one verb governs another in the infinitive, the objective pronoun may come before the first or after the second verb; as—

El Aleman *la* va á ver; *or*, el Aleman va á ver*la.*

The German her *goes to see;* or, *the German goes to see*-her.

The first or second person plural of the imperative drops its final letter when *nos* or *os* is joined to it; as—

Sentámonos (and not sentámosnos), *let-us-seat-ourselves.*

Guardáos (and not guardados), *guard-yourselves.*

Ello, and its objective case *lo*, are properly used for a noun to which we cannot assign any gender; and though not strictly correct, the practice is allowed of using *lo* for the masculine *le*, if this pronoun be directly governed by a verb.

Personal pronouns must always agree with the nouns for which they are substituted in gender, person, and number.

VOCABULARY.

Alguno, *some, any.*
Comprar, (*to*) *buy.*
Confianza, *confidence.*
Dar, (*to*) *give.*
Hablar, (*to*) *speak.*
Hablaron, (*they*) *spoke.*
Habló, (*he*) *spoke.*
Hizo, (*he*) *made*, (*he*) *did.*
Mucho, *much, many.*
Nosotros somos, *we are.*
Para, *for.*
Pedro, *Peter.*
Traed, *bring* (*ye*).
Tú eres, *thou art.*
Ver, (*to*) *see.*
Vinieron, (*they*) *came.*
Vino, (*he*) *came.*
Vió, (*he*) *saw.*
Yo† soy, *I am.*
Yo voy, *I go, I am going.*

EXERCISE 9.

(*The Personal Pronouns are in Italics.*)

Translate into English:—

1. Pedro *me* escribió dos cartas. 2. *Ella le* dió un libro. 3. *El los* halló. 4. *Ella les* escribió algunas cartas. 5. El médicoo *les* habló. 6. *Yo* soy pobre y viejo. 7. *Tú* eres muy sábio. 8. *El* es ignorante. 9. *Nosotros* somos fuertes y ricos. 10. El pintor *te* dió una cuchara de plata. 11. La muger *nos* vió. 12. El carpintero *nos* habló. 13. Los Españoles *le* hablaron. 14. El juez tiene mucha confianza en *V.* 15. Pedro *le* dió el libro. 16. El Aleman no *le* dió dinero. 17. La Alemana no *le* habló. 18. La muger no *me* habló. 19. El pintor no *te* vió. 20. El carpintero no *los* halló. 21. *Yo* voy á dar*le* un libro. 22. *V.* es rico. 23. *VV.* son pobres. 24. *VV.* son sobérbios.

In forming a negative sentence, the adverb *no* must come not only before the verb, but even before personal pronouns of the first objective case; as, Juan no me lo dijo, *John not to-me it said*—i.e., *John said it not to me.*

Vuestra merced, contracted into *usted* (which is written *V.*), though of the third person, is equivalent to the English word *you;* thus the sentence "you are rich," if addressed to one person, would be V. es rico (*your worship is rich*); if addressed to more than one person, VV. son ricos (*your worships are rich*). When females are referred to, the feminine form of the adjective must be used.

EXERCISE 10.

Translate into Spanish:—

1. Peter wrote me two letters. 2. The painter gave him a book. 3. She found them. 4. He wrote to-them some letters. 5. I am poor and old. 6. The judge spoke to-them. 7. Thou art very rich. 8. He is wise. 9. We are ignorant. 10. They are strong and rich. 11. The painter gave thee a silver spoon. 12. The woman saw us. 13. The carpenter spoke to us. 14. The Spanish woman spoke to him. 15. The physician saw him. 16. The Frenchwoman saw them (masc.). 17. The German woman saw them (fem.). 18. The carpenter made it (*lo*) for him. 19. The painter has confidence in her. 20. The printers have much confidence in him. 21. The Englishman made it for me. 22. You gave me a book. 23. You are very wise. 24. You are hungry. 25. You have a house. 26. You (plur.) are thirsty. 27. You (plur.) are not proud. 28. You (plur.) love the truth. 29. The physician has much confidence in you. 30. I am-going to give you (*le*) a book.

KEY TO EXERCISES.

Ex. 1.—1. The judge. 2. The physician. 3. The (female) servant. 4. The American's sister. 5. A man-servant of the judge. 6. A daughter of the physician. 7. The future. 8. To the soul of the mistress. 9. The hunger of the (male) servant. 10. The son of the physician's brother. 11. The woman's servant. 12. To the judge's brother. 13. To a daughter of the American. 14. The past. 15 The men. 16. The Frenchwoman's sisters. 17. To the woman's daughters. 18. The brothers of the (female) servants.

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* A *gerund* is used in Spanish as the present participle in English; as, amando, *loving.*

† For the present we shall use the nominative personal pronouns with the verb, though they are not generally required unless for the sake of emphasis or perspicuity.

Ex. 2.—1. El hombre. 2. La muger. 3. El alma. 4. Las hijas. 5. El hermano del médico 6. El marido de la muger. 7. La hermana del juez. 8. Los hijos del Americano. 9. Á los hermanos del médico. 10. Á las almas de las criadas. 11. Las hijas de la Francesa. 12. Los criados de los hijos del médico. 13. Los maridos de las hijas del juez. 14. Los hermanos de las criadas.

Ex. 3.—1. The printers have money. 2. The women are hungry. 3. The painters have books 4 The judges are thirsty. 5. The women gave books to the Frenchwoman's father. 6. The men gave money to the American's mother 7. The carpenters went to the painter's house. 8. The judges wrote letters to the painter's mother 9. The ship-carpenters have money.

Ex. 4.—1. Los pintores tienen dinero 2. Las mugeres tienen maridos. 3. Los carpinteros dieron un libro al hijo del juez. 4. Las hijas de la Francesa escribieron cartas á los hijos del juez. 5. El médico escribieron cartas á la madre del pintor. 6. Los criados del médico escribieron cartas á las criadas de la Francesa. 7. Los impresores fueron á casa del juez. 8. Los caballos tienen hambre. 9. Los bueyes tienen sed.

COMPARATIVE ANATOMY.—IV.

[*Continued from p.* 307]

ANTHOZOA (FLOWER-LIKE ANIMALS) (*continued*).

ALL the forms hitherto referred to belong to one order called the Zoantharia, or animal flowers. These are the only corals which have stony partitions developed from those membranes which, running from the stomach wall to the body wall, are called septa. A curious numerical law applies to these septa. However many of them there may be, and there are sometimes hundreds of them, they are always in some multiples of 6.

If the reader should be fond of wandering at the edge of the sea at ebb tide in many parts of our coasts, he will be almost sure to find some orange or yellow masses whose size and form will remind him of the roots of ginger. The livid appearance of these, together with their soft fleshy feel, has earned for them the cognomen of dead men's fingers. If, however, these be placed in an aquarium, they put out. from all parts of their surface, little flower-like heads. Each of the heads is crowned with eight tentacles arranged in the form of a star, and each of these is fringed with secondary tentacles. In most other respects they resemble the Zoantharia, but they are cut off from them by two other marked differences. All their parts are in multiples of 8, and their membranous partitions never secrete hard septa. Sometimes, however, they develop tubular corals, which after budding from a common stock, send out from the outsides of these tubes lateral platforms, which unite and support the several tubes. The parallel tubes so supported look not unlike organ pipes, or those reed instruments which are fixed under the mouth of that musician who so generally accompanies Punch and Judy. In consequence of this resemblance the animal which forms them is called *Tubipora musica.*

The more general habit, however, is for the animals to secrete from their bases only. Nevertheless, this secretion is so managed as to raise the compound animal from the rock on which it grows. These animals put forth buds from the circumference of their basal discs, and thus a number of these polypes are placed horizontally with their bases united, so as to enclose an elongated hollow in which they secrete the dense, hard, and sometimes beautiful and branching coral. The red coral obtained from the coasts of Italy, which is so much prized for the manufacture of ornaments, is of this nature. Another family of the same order produce corals in a similar way, but of different shape. These are not fixed like the red coral, but consist of a main axis from which many parallel branches, forming two series on opposite sides, spring. The appearance is so exactly like that of a wing-feather of a bird with its barbules, that the family is called *Pennatulidæ*, or the family of quill-pens.

Another widely different order, or, as some zoologists think, a distinct group, which has been called that of the CTENOPHORA (or comb-bearers), is represented by the *Pleurobrachia*, an illustration of which is given on p. 252. This little animal may be found washed up at the edge of the wave on the eastern coast. It is about the size of a large gooseberry, but in shape more like a lemon, with a small elevation at one end and a depression at the other. The substance of the animal is as transparent and as clear as crystal, and it shines in the sun like opal. Attracted by the appearance of this little symmetrical lump of jelly, the beholder on further examination finds that a flickering motion is seen to play along eight bands which run from pole to pole of the animal. If he take the little glistening globe and place it in a tumbler of sea-water, it puts forth two long streaming tentacles, whose secondary branches look like long fringes. The anatomical study of this animal reveals that the flickering along the meridional zones is caused by an apparatus consisting of a number of semicircular plates, which are set on the body with their diameters applied to the surface, the half-circular side free and bearing a fringe of hairs or cilia, which are constantly in motion, and which, in fact, are the means of propelling the animal. These plates with their cilia are considered to be like combs, whence the name of the group. The mouth opens at the end, where there is a slight protuberance, and it leads down to a curious branched system of canals, best understood by a reference to the illustration. (Fig. 17, p. 252.)

Another family of the Ctenophora is represented by a strap-shaped animal, which is called *Cestus Veneris*, or the girdle of Venus. This animal occurs in the Mediterranean Sea, and is described as very beautiful. The idea which suggested the name is poetic and appropriate, for from the foam of the sea which washes classic shores Venus was supposed to have sprung, and as she emerged she left her zone behind,

The Anthozoa, especially the Zoantharia, play an important part in modifying the earth's crust, for these are the animals which produce the coral reefs and coral islands. The animals mainly concerned in building up coral reefs cannot live at more than about 10 to 30 fathoms below the surface, and of course they cannot live above it, but they delight in the boisterous waters of the surface. Their instincts guide them to build up on almost all coasts of the tropical seas long banks or bars, which are always highest on the ocean side, and highest of all towards the direction from which the fiercest winds blow.

Those banks or reefs come to the surface at some distance from the shore, and enclose a lagoon of still water, which is a safe harbour for ships. Certain islands in the South Seas are entirely composed of coral, and they are almost all of a circular form, enclosing a basin of water. These ring-like islands are called atolls. The enclosed basin is shallow, but outside the island, even close to the shore, the sea is very deep. The phenomena of reefs furnished to our renowned naturalist, Darwin, a means of proving that the crust of the earth was being slowly upheaved or slowly depressed in different areas.

Fig. 20.—AN ATOLL, OR CIRCULAR CORAL ISLAND, WITH A LAKE IN THE CENTRE.

In Figs. 20, 21, 22, and 23 the principal forms of reefs are represented as though we had cut perpendicularly down through land, reef, and sea, and so could see their relations.

In Fig. 22, A represents a volcanic island surrounded by a barrier reef with its enclosed lagoon. Suppose this to be slowly lowered in relation to the surrounding sea, the corals will continue to build on their old foundation, maintaining their position at the surface, while the solid mountain disappears, and at last a ring-like reef, or atoll, is formed.

If, on the other hand, the land rise, the corals are killed, and fresh ones must begin farther down on the submarine flanks of the mountain, while a *fringing* reef (Fig. 21) is left on the side of the mountain above sea-level.

The actual position of many coral reefs corresponds well with this theory.

VERMES (WORMS).

Under the head of Vermes are included a number of forms which have but little relation with one another, and many of which are perhaps connected with one or other of the great higher groups which we shall have to consider later on. Of the very different kinds of worms, we can consider only a few. First we will deal with those worms whose organisation is considerably degraded by their habit of living in, and at the expense of, other animals; such worms are called parasites.

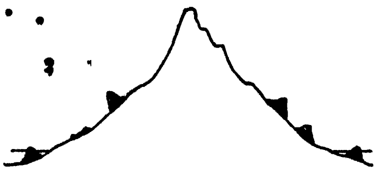

Fig. 21.—Fringing Reefs.

One of the best-known and most typical forms of the parasite worms is the common tapeworm, called *Tænia solium*. The name *Tænia* means a band, and is given because of the long, flat, strap-shaped character of the animal's body.

This remarkable creature is found in the alimentary canal of man. It is often many feet in length. Its head is armed with two kinds of organs for effecting its adhesion to the sides of the intestines. It has a proboscis, and around this are two rows of hooks, which point backward, so that when the animal plunges its proboscis into the soft mucous coat it cannot be pulled away, and hence holds its position, notwithstanding the continued transmission of food and the constant motion of the alimentary canal by which it passes forward its contents. Besides these, four suckers are situated below the hooklets on the rounded head. An attenuated neck gradually enlarges as it proceeds downwards, and, at a little distance from the head, closely set and fine constrictions are observed, which become larger and more especially longer as we trace them downwards towards the tail-end. These constrictions become also more and more definite and deeper, dividing the animal into segments, which, being longer than wide, and very flat, look like a series of oblong cards.

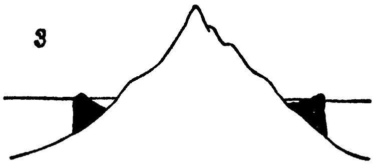

Fig 22.—Formation of Atoll—1.

In each of these segments a complete set of reproductive organs, both male and female, are found, and each in course of time produces an immense brood of eggs. When this condition has been arrived at, the segment drops off and crawls about, making its escape from its host, and finally bursting from the increased growth of the contained eggs, it scatters an immense multitude of germs. At a first consideration, one would have thought that these germs, cast forth into the world, and dependent for development upon their admission to other hosts, would have but little chance of complete life; and this is no doubt true with regard to each single germ. In this case, however, Nature makes up by multitude for efficiency. If we consider that each tapeworm has many hundred segments or joints when found in the interior of man, and that these joints are continually renewed from above as they fall away, and that each segment contains thousands of ova which are cast into various situations—into garbage, water, etc —it is not wonderful that some are taken into the interior of some suitable host.

These animals, being constantly provided with digested food which has been elaborated by their hosts, do not need any food canal of their own to digest aliment, but absorb it when already dissolved through the walls of their body Running along each side of the animal is a narrow duct. Cross-branches unite the two ducts, one to each segment, and run across at the part farthest from the head. These two lateral canals were long considered as the alimentary system of the animal; but it was found that it had no opening forward—that is, it was without a mouth—and although there is an opening at the other end of the body, yet it is now considered as the water-vascular system.

The egg with its contained embryo being swallowed, does not remain in the food canal and become developed into a tapeworm, as might have been supposed, but immediately that the coatings of the egg are dissolved away, the embryo, which is armed with six boring-hooks, makes its way through the walls of the alimentary canal, and traverses the body in any direction until it reaches some structure suited to it, and there it rests and becomes more fully developed. The development is commenced by the formation of a bladder which is proper to

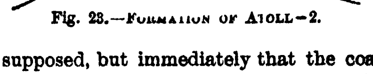

Fig. 23.—Formation of Atoll—2.

the animal, while the soft organ in which the parasite is lodged forms a self-defensive cyst around this of common (areolar) tissue. Thus the creature is snugly ensconced in a cavity, through the walls of which the liquids penetrate, and are absorbed by the bladder-like animal. By the aid of this nutriment fresh changes occur with the growth of the larva. Thus on one side of the interior of the bladder a round body grows and so projects into the cavity, and in this the head and neck of the future perfect worm are formed. On this head the circles of hooks and the suckers are developed, so that the examination of the larval form when at an advanced stage will enable the examiner to determine to which species the creature belongs. When this process is completed, the larva has reached a stage beyond which it cannot become more developed unless it changes its position, and this change of position is not an active but a passive one. Hence multitudes of these creatures probably die and become disintegrated without ever attaining the perfect form. Those, however, whose life-circuit becomes complete, are transferred to the stomach of a carnivorous animal by the flesh in which they are lodged being devoured. Thus the animal has two different hosts, one of which entertains it in the immature condition, and the other when it becomes perfect and sexually capable of reproducing its species. Most of these *cystoid* animals, when in the cystoid or bladder-like state, inhabit the soft structure of herbivorous or grain-feeding animals; while when they arrive at the *cestoid* or tape-worm condition, they are found in the carnivorous animals which feed upon their former hosts. It has been shown that the *Cysticercus fasciolaris* of the liver of a mouse becomes the *Tænia crassicollis* (the thick-necked tapeworm) of the intestines of the cat, and the *Cysticercus pisiformis* (the pea-shaped bladder-tail) of the rabbit becomes the *Tænia serrata* (notched tapeworm) of the dog. In the case of the species we have been describing, the host of the larva is usually the pig, and the host of the adult worm is man. As might be expected, it is found that the *Tænia solium* infects those most who are especially fond of ill-cooked sausages. In Germany this unfortunate taste for nearly raw pork has produced the most harmful results, not only by introducing this worm, but also another, called *Trichina spiralis*, a worm of much higher organisation, and belonging to an order to be referred to hereafter. When the flesh containing the encysted entozoon is being digested by the animal who has been unfortunate enough to swallow it, the digesting operation goes on not only so far as to liberate the creature, but also to dissolve away the bladder which encloses the head. Then the creature, like the liberated genius in the "Arabian Nights" begins to take revenge on its liberator for its long imprisonment. It fixes itself by its hooks and its suckers to the walls of the intestines, and its neck grows and becomes segmented as before described. As compared to the immense length and size of the chain of segments, the head is ridiculously small; and thus the simile of the genius, who, when liberated from his bottle, assumed such vast and formidable dimensions, is not inappropriate to the rapid development which follows the liberation of this worm from its cyst.

The effect upon the human system occasioned by tapeworms is extremely distressing. The patient suffers not only from loss of appetite, emaciation, and lassitude, but the sympathetic nervous system is affected so as to produce convulsions and epilepsy. Distressing, however, as these effects are, they are not so fatal as are those produced by the presence of the immature form, because the adult worm is confined to the intestines, and is thus, so to speak, in a situation external to the body, while the larvæ, as we have seen, penetrate into all parts of the body, and their presence is more or less injurious as they take up their abode in the more or less vital organs. If they find their way to a position under the skin or in the muscles, they are comparatively harmless; but if they penetrate the eye or the brain, they occasion pain and sometimes death.

In tracing the circle of life of the *Tænia*, we find it runs through all the forms named, in the following order:—

1. The egg.
2. The embryo, actively travelling by a six-hooked boring apparatus.
3. The resting larva, consisting of a head enveloped in a terminal bladder.
4. Immature tapeworm liberated from its bladder.
5. Segmented and sexually mature tapeworm.
6. Free segment; called a proglottis, from its likeness to the tip of the tongue.

GERMAN.—XXXVI.

[*Continued from p. 303.*]

PARADIGM OF A VERB OF THE OLD FORM.

Schlagen (to strike) is thus conjugated:—

INDICATIVE MOOD.

	PRESENT		PAST.
S.	Ich ſchlage, I strike.	*S.*	Ich ſchlug, I struck.
	Du ſchlägſt.		Du ſchlugſt.
	Er ſchlägt.		Er ſchlug.

PRESENT.	PAST.
P. Wir ſchlagen.	*P.* Wir ſchlugen.
Ihr ſchlagt.	Ihr ſchlugt.
Sie ſchlagen.	Sie ſchlugen.

PRESENT PERFECT.	PLUPERFECT.
S. Ich habe geſchlagen, I have struck.	*S.* Ich hatte geſchlagen, I had struck.
Du haſt geſchlagen.	Du hatteſt geſchlagen.
Er hat geſchlagen.	Er hatte geſchlagen.
P. Wir haben geſchlagen.	*P.* Wir hatten geſchlagen.
Ihr habet geſchlagen.	Ihr hattet geſchlagen.
Sie haben geſchlagen.	Sie hatten geſchlagen.

FUTURE IMPERFECT	FUTURE PERFECT.
S. Ich werde ſchlagen, I shall strike.	*S.* Ich werde geſchlagen haben, I shall have struck.
Du wirſt ſchlagen.	Du wirſt geſchlagen haben.
Er wird ſchlagen.	Er wird geſchlagen haben.
P. Wir werden ſchlagen.	*P.* Wir werden geſchlagen haben
Ihr werdet ſchlagen.	Ihr werdet geſchlagen haben.
Sie werden ſchlagen.	Sie werden geſchlagen haben.

SUBJUNCTIVE MOOD.

PRESENT	PAST
S. Ich ſchlage, I may strike.	*S.* Ich ſchlüge, I might strike.
Du ſchlageſt	Du ſchlügeſt.
Er ſchlage.	Er ſchlüge.
P. Wir ſchlagen.	*P.* Wir ſchlügen.
Ihr ſchlaget	Ihr ſchluget.
Sie ſchlagen.	Sie ſchlügen.

PRESENT PERFECT.	PLUPERFECT
S. Ich habe geſchlagen, I may have struck.	*S.* Ich hätte geſchlagen, I might have struck.
Du habeſt geſchlagen.	Du hätteſt geſchlagen.
Er habe geſchlagen.	Er hätte geſchlagen.
P. Wir haben geſchlagen.	*P.* Wir hätten geſchlagen..
Ihr habet geſchlagen.	Ihr hättet geſchlagen.
Sie haben geſchlagen.	Sie hätten geſchlagen.

FUTURE IMPERFECT.	FUTURE PERFECT.
S. Ich werde ſchlagen, (if) I shall strike.	*S.* Ich werde geſchlagen haben, (if) I shall have struck.
Du werdeſt ſchlagen.	Du werdeſt geſchlagen haben.
Er werde ſchlagen.	Er werde geſchlagen haben.
P. Wir werden ſchlagen.	*P.* Wir werden geſchlagen haben.
Ihr werdet ſchlagen.	Ihr werdet geſchlagen haben.
Sie werden ſchlagen.	Sie werden geſchlagen haben.

CONDITIONAL MOOD.

FUTURE IMPERFECT.	FUTURE PERFECT.
S. Ich würde ſchlagen, I should strike.	*S.* Ich würde geſchlagen haben, I should have struck.
Du würdeſt ſchlagen.	Du würdeſt geſchlagen haben.
Er würde ſchlagen.	Er würde geſchlagen haben.
P. Wir würden ſchlagen.	*P.* Wir würden geſchlagen haben.
Ihr würdet ſchlagen.	Ihr würdet geſchlagen haben.
Sie würden ſchlagen.	Sie würden geſchlagen haben.

IMPERATIVE MOOD.

PRESENT.

Sing.	Schlage (du), strike thou.
	Schlage er, let him strike.
Plur.	Schlagen wir, let us strike.
	Schlaget (ihr), strike ye
	Schlagen ſie, let him strike.

INFINITIVE MOOD.

PRESENT.	Schlagen, to strike.
PERFECT.	Geſchlagen haben, to have struck.
FIRST FUT.	Schlagen werden, to be about to strike.

PARTICIPLE.

PRESENT.	PERFECT.
Schlagend, striking.	Geſchlagen, struck.

ALPHABETICAL LIST OF VERBS OF THE OLD FORM.

(Commonly called Irregular Verbs.)

NOTE that in the following list many *compound* forms are not set down. In such case, the student has only to look for the verb in its *simple* form. The list should not be learnt by heart, but constantly referred to when the student in the course of his reading is confronted by difficult or unusual forms.

INFINITIVE.	INDICATIVE. *Present.*	INDICATIVE. *Past.*	SUBJUNCTIVE *Past.*	IMPERATIVE.	PARTICIPLE.
Backen, (1) to bake	ich backe, du bäckſt, er bäckt, ꝛc.	ich buk	ich büke	backe	gebacken
Befehlen, to command	ich befehle, du befiehlſt, er befiehlt, ꝛc.	ich befahl	ich beföhle	befiehl	befohlen
Befleißen (ſich), to apply oneself	ich befleiße, ꝛc.	ich befliß	ich befliſſe	befleiße	befliſſen
Beginnen, (2) to begin	ich beginne, ꝛc.	ich begann	ich begänne	beginne	begonnen

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(1) Regular when active, as :—Er backte Brod ; Das Brod buk. (2) In the past subjunctive, begönne is also used.

INFINITIVE.	INDICATIVE. *Present.*	INDICATIVE. *Past.*	SUBJUNCTIVE. *Past.*	IMPERATIVE.	PARTICIPLE.
Beißen, to bite	ich beiße, ꝛc.	ich biß	ich biſſe	beiße	gebiſſen
Beklemmen, (3) to pinch, press (by anxiety)	ich beklemme, ꝛc.	ich beklomm	ich beklemmte	beklemme	beklommen (beklemmt)
Bergen, to conceal	ich berge, du birgſt, er birgt, ꝛc.	ich barg	ich bärge	birg	geborgen
Berſten, to burst	ich berſte, ꝛc.	ich borſt *or* barſt	ich bärſte	berſte *or* birſt	geborſten
Betrügen, to deceive	ich betrüge, ꝛc.	ich betrog	ich betröge	betrüge	betrogen
Bewegen, (4) to induce	ich bewege, ꝛc.	ich bewog	ich bewöge	bewege	bewogen
Biegen, to bend	ich biege, ꝛc.	ich bog	ich böge	biege	gebogen
Bieten, (5) to offer, to bid	ich biete, ꝛc.	ich bot	ich böte	biete	geboten
Binden, to bind	ich binde, ꝛc.	ich band	ich bände	binde	gebunden
Bitten, to entreat, to beg	ich bitte, ꝛc.	ich bat	ich bäte	bitte	gebeten
Blaſen, to blow	ich blaſe, du bläſeſt, er bläſt, ꝛc.	ich blies	ich blieſe	blaſe	geblaſen
Bleiben, to remain	ich bleibe, ꝛc.	ich blieb	ich bliebe	bleibe	geblieben
Braten, to roast	ich brate, du brateſt *or* brätſt, er bratet *or* brät, ꝛc.	ich briet	ich briete	brate	gebraten
Brechen, to break	ich breche, du brichſt, er bricht, ꝛc.	ich brach	ich bräche	brich	gebrochen
Brennen, to burn	ich brenne, ꝛc.	ich brannte	ich brennte	brenne	gebrannt
Bringen, to bring	ich bringe, ꝛc.	ich brachte	ich brächte	bringe	gebracht
Denken, to think	ich denke, ꝛc.	ich dachte	ich dächte	denke	gedacht
Dingen, (6) to bargain	ich dinge, ꝛc.	ich dung	ich dünge	dinge	gedungen
Dreſchen, to thrash	ich dreſche, du driſcheſt, er driſcht, ꝛc.	ich droſch	ich dräſche *or* dröſche	driſch	gedroſchen
Dringen, (7) to press, to urge	ich dringe, ꝛc.	ich drang	ich dränge	dringe	gedrungen
Dürfen, to be allowed	ich darf, du darfſt, er darf, ꝛc	ich durfte	ich dürfte	dürfe	gedurft
Empfangen, to receive	ich empfange, du empfängſt, er empfängt, ꝛc.	ich empfing	ich empfinge	empfange	empfangen
Empfehlen, to recommend	ich empfehle, du empfiehlſt, er empfiehlt, ꝛc.	ich empfahl	ich empföhle	empfiehl	empfohlen
Erbleichen, (8) to turn pale	ich erbleiche, ꝛc.	ich erblich	ich erbliche	erbleiche	erblichen
Erkieſen Erkühren } to select, to choose	ich erkühre (erküre), ꝛc.	ich erkor (erkohr)	ich erkühre (erküre)	erkühre (erküre)	erkohren (erkoren)
Erlöſchen, (9) to extinguish	ich erlöſche, du erliſcheſt, er erliſcht, ꝛc.	ich erloſch	ich erlöſchte	erlöſche	erloſchen
Erſchallen, to resound	ich erſchalle, ꝛc.	ich erſcholl	ich erſchölle	erſchalle	erſchollen
Erſchrecken, (10) to be frightened	ich erſchrecke, du erſchr.., er erſchrickſt, ꝛc.	ich erſchrak	ich erſchräke	erſchrick	erſchrocken
Erwägen, (11) to consider	ich erwäge, ꝛc.	ich erwog	ich erwöge	erwäge	erwogen
Eſſen, to eat	ich eſſe, du iſſeſt, er ißt, ꝛc.	ich aß	ich äße	iß	gegeſſen
Fahren, (12) to drive in a carriage	ich fahre, du fährſt, er fährt, ꝛc.	ich fuhr	ich führe	fahre	gefahren
Fallen, to fall	ich falle, du fällſt, er fällt	ich fiel	ich fiele	falle	gefallen
Fangen, (13) to catch	ich fange, du fängſt, er fängt	ich fing	ich finge	fange	gefangen
Fechten, to fight	ich fechte, du fechteſt *or* fichtſt, er fechtet *or* ficht, ꝛc.	ich focht	ich föchte	fechte (ficht)	gefochten
Finden, to find	ich finde, ꝛc.	ich fand	ich fände	finde	gefunden
Flechten, to twist	ich flechte, du flechteſt *or* flichtſt, er flechtet *or* flicht	ich flocht	ich flöchte	flechte (flicht)	geflochten

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(3) Beklemmt is not frequently used, and is employed only in the sense of *compressed.* (4) Irregular when it means *to induce;* regular when it means "to move a *body* or affect the *sensibilities.*" (5) Beutſt and beut, in the present, are poetical. (6) Dingte is sometimes used in the past in the sense of *hire.* (7) For drang, drung was formerly in use. (8) Derived from bleichen, *to whiten as in the sun*, which is regular. (9) Like verlöſchen and auslöſchen, irregular only when intransitive. Löſchen is always transitive and regular. (10) Irregular always as an intransitive verb, but regular when transitive. (11) More frequently used as a regular verb. (12) All the compounds of fahren are irregular except willfahren. (13) The forms fieng and fienge are obsolete.

INFINITIVE.	INDICATIVE. *Present.*	INDICATIVE. *Past.*	SUBJUNCTIVE. *Past.*	IMPERATIVE.	PARTICIPLE.
Fliegen, (14) to fly	ich fliege, du fliegſt, er fliegt, ꝛc.	ich flog	ich flöge	fliege	geflogen
Fliehen, (15) to flee	ich fliehe, ꝛc.	ich floh	ich flöhe	fliehe	geflohen
Fließen, (16) to flow	ich fließe, ꝛc.	ich floß	ich flöſſe	fließe	gefloſſen
Freſſen, to devour	ich freſſe, du friſſeſt, er frißt, ꝛc.	ich fraß	ich fräße	friß	gefreſſen
Frieren, to freeze	ich friere, ꝛc.	ich fror	ich fröre	friere	gefroren
Gähren, (17) to ferment	ich gähre ꝛc	ich gohr	ich göhre	gähre	gegohren
Gebären, to bring forth	ich gebäre, du gebärſt (gebierſt), er gebärt (gebiert)	ich gebar	ich gebäre (geböre)	gebäre (gebier)	geboren
Geben, (18) to give	ich gebe, du gibſt, er gibt, ꝛc.	ich gab	ich gäbe	gib	gegeben
Gedeihen, (19) to prosper	ich gedeihe, ꝛc.	ich gedieh	ich gediehe	gedeihe	gediehen
Gehen, (20) to go	ich gehe, ꝛc.	ich ging	ich ginge	gehe	gegangen
Gelingen, to succeed	es gelingt	es gelang	es gelänge	gelinge	gelungen
Gelten, (21) to be worth, valid	ich gelte, du giltſt, er gilt, ꝛc.	ich galt	ich gälte	gilt	gegolten
Geneſen, to recover	ich geneſe, ꝛc.	ich genaß	ich genäſe	geneſe	geneſen
Genießen, (22) to enjoy	ich genieße, ꝛc	ich genoß	ich genöſſe	genieße	genoſſen
Geſchehen, to happen	es geſchieht, ꝛc.	es geſchah	es geſchähe	geſchehe	geſchehen
Gewinnen, to gain, to win	ich gewinne, ꝛc.	ich gewann	ich gewänne (gewönne)	gewinne	gewonnen
Gießen, (23) to pour	ich gieße, ꝛc.	ich goß	ich göſſe	gieße	gegoſſen
Gleichen, to resemble	ich gleiche, ꝛc.	ich glich	ich gliche	gleiche	geglichen
Gleiten, (24) to glide	ich gleite ꝛc.	ich glitt	ich glitte	gleite	geglitten
Glimmen, (25) to sparkle	ich glimme, ꝛc	ich glomm	ich glomme	glimme	geglommen
Graben, to dig	ich grabe, du gräbſt, er gräbt, ꝛc	ich grub	ich grübe	grabe	gegraben
Greifen, to seize	ich greife, ꝛc	ich griff	ich griffe	greife	gegriffen
Haben, (26) to have	ich habe, du haſt, er hat, ꝛc.	ich hatte	ich hätte	habe	gehabt
Halten, to hold	ich halte, du hältſt er hält	ich hielt	ich hielte	halte	gehalten
Hangen, to hang	ich hange, du hängſt, er hängt, ꝛc	ich hing	ich hinge	hange	gehangen
Hauen, (27) to hew	ich haue, ꝛc.	ich hieb	ich hiebe	haue	gehauen
Heben, to heave, lift	ich hebe, ꝛc.	ich hob *or* hub	ich höbe	hebe	gehoben
Heißen, to be named	ich heiße, ꝛc	ich hieß	ich hieße	heiße	geheißen
Helfen, to help	ich helfe, du hilfſt, er hilft, ꝛc	ich half	ich hülfe *or* hälfe	hilf	geholfen
Keifen, (28) to chide	ich keife, ꝛc.	ich kiff	ich kiffe	keife	gekiffen
Kennen, to know	ich kenne, ꝛc.	ich kannte	ich kennte	kenne	gekannt
Klimmen, (29) to climb	ich klimme, ꝛc.	ich klomm	ich klömme	klimme	geklommen
Klingen, to sound	ich klinge ꝛc	ich klang	ich klänge	klinge	geklungen
Kneifen, to pinch	ich kneife, ꝛc.	ich kniff	ich kniffe	kneife	gekniffen
Kommen, to come	ich komme du kommſt, er kommt, *or* du kömmſt, er kömmt, ꝛc.	ich kam	ich käme	komm	gekommen
Können, to be able	ich kann, du kannſt, er kann, ꝛc.	ich konnte	ich könnte	könne	gekonnt
Kriechen, to creep	ich krieche, ꝛc.	ich kroch	ich kroche	krieche	gekrochen
Laden, to load	ich lade, du ladeſt *or* lädſt, er ladet *or* lädt, ꝛc.	ich lud	ich lüde	lade	geladen
Laſſen, (30) to let	ich laſſe, du läſſeſt, er läßt, ꝛc.	ich ließ	ich ließe	laſſe *or* laß	gelaſſen
Laufen, to run	ich laufe, du läufſt, er läuft	ich lief	ich liefe	laufe	gelaufen

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(14) Fleugſt and fleugt in the present, and fleug in the imperative, are forms used only in poetry. (15) Fleuchſt, fleucht, and fleuch, poetical. (16) Fleußeſt, fleußt, and fleuß, poetical. (17) Sometimes regular, gährte. (18) Some writers prefer giebſt, giebt, gieb, to gibſt, gibt, gib (19) Gediegen is but a strengthened adjective form of the past participle. (20) Gieng, for ging, is antiquated. (21) Formerly golt, golte, were used in the past indicative and subjunctive. (22) Geneußeſt, geneußt, and imperative geneuß, poetical; seldom used. (23) Geußeſt, geußt, and imperative geuß (*see* gießen). (24) Geleiten and begleiten are not derived from gleiten, but from leiten, and are therefore regular. (25) Now more frequently regular. (26) Handhaben is regular. (27) Hauen is also regular. (28) Keifen, a neuter verb, which has haben as its auxiliary. (29) Klimmen is also regular. (30) Veranlaſſen is regular.

INFINITIVE.	INDICATIVE. *Present.*	INDICATIVE. *Past.*	SUBJUNCTIVE. *Past.*	IMPERATIVE.	PARTICIPLE.
Leiden, (31) to suffer	ich leide, ꝛc.	ich litt	ich litte	leide	gelitten
Leihen, to lend	ich leihe, ꝛc.	ich lieh	ich liehe	leihe	geliehen
Leſen, to read	ich leſe, du lieſeſt, er lieſt, ꝛc.	ich las	ich läſe	lies	geleſen
Liegen, to lie down	ich liege, ꝛc.	ich lag	ich läge	liege	gelegen
Lügen, to lie	ich lüge, ꝛc.	ich log	ich löge	lüge	gelogen
Mahlen, (32) to grind	ich mahle, ꝛc.	ich mahlte	ich mahlte	mahle	gemahlen
Meiden, to avoid	ich meide, ꝛc.	ich mied	ich miede	meide	gemieden
Melken, (33) to milk	ich melke, du melkſt *or* milkſt, er melkt *or* milkt	ich molk	ich mölke	melke	gemolken
Meſſen, to measure	ich meſſe, du miſſeſt, er mißt, ꝛc.	ich maß	ich mäße	miß	gemeſſen
Mißlingen, to go amiss	es mißlingt	es mißlang	es mißlänge	mißlinge	mißlungen
Mögen, to be able	ich mag, du magſt, er mag	ich mochte	ich möchte	möge	gemocht
Müſſen, to be obliged	ich muß, du mußt, er muß	ich mußte	ich müßte	müſſe	gemußt
Nehmen, to take	ich nehme, du nimmſt, er nimmt, ꝛc.	ich nahm	ich nähme	nimm	genommen
Nennen, to name	ich nenne, ꝛc.	ich nannte	ich nennte	nenne	genannt
Pfeifen, to whistle	ich pfeife, ꝛc.	ich pfiff	ich pfiffe	pfeife	gepfiffen
Pflegen, (34) to cherish	ich pflege, ꝛc.	ich pflog	ich pflöge	pflege	gepflogen
Preiſen, to praise	ich preiſe, ꝛc.	ich pries	ich prieſe	preiſe	geprieſen
Quellen, to gush	ich quelle, du quillſt, er quillt	ich quoll	ich quölle	quelle, quill	gequollen
Rächen, (35) to avenge	ich räche, ꝛc.	ich rächte (roch)	ich rächte (röche)	räche	gerächt (ge-rochen)
Rathen, to advise	ich rathe, du räthſt, er räth, ꝛc.	ich rieth	ich riethe	rathe	gerathen
Reiben, to rub	ich reibe, ꝛc.	ich rieb	ich riebe	reibe	gerieben
Reißen, to tear	ich reiße, ꝛc.	ich riß	ich riſſe	reiße	geriſſen
Reiten, (36) to ride	ich reite, ꝛc.	ich ritt	ich ritte	reite	geritten
Rennen, to run	ich renne, ꝛc.	ich rannte	ich rennte	renne	gerannt
Riechen, to smell	ich rieche, ꝛc.	ich roch	ich röche	rieche	gerochen
Ringen, to wrestle	ich ringe, ꝛc.	ich rang	ich ränge	ringe	gerungen
Rinnen, to run (of fluids)	ich rinne, ꝛc.	ich rann	ich ränne (rönne)	rinne	geronnen
Rufen, to call	ich rufe, ꝛc.	ich rief	ich riefe	rufe	gerufen
Salzen, to salt	ich ſalze, ꝛc.	ich ſalzte	ich ſalzte	ſalze	geſalzen
Saufen, to drink, to tipple	ich ſaufe, du ſäufſt, er ſäuft, ꝛc.	ich ſoff	ich ſöffe	ſaufe	geſoffen
Saugen, to suck	ich ſauge, ꝛc	ich ſog	ich ſöge	ſauge	geſogen
Schaffen, (37) to create	ich ſchaffe, ꝛc.	ich ſchuf	ich ſchüfe	ſchaffe	geſchaffen

(31) Verleiden, *to disgust*, is regular. (32) Except the past participle, gemahlen, no irregular form is in use. (33) Sometimes regular. Milkſt, etc., rarely used. (34) When it signifies *to wait upon*, or *to be accustomed*, it is regular. (35) The irregular form is no longer used. Where it occurs in former writers it must not be confounded with the same forms from riechen. (36) Bereiten, *to break in* (horses), like all the compounds of reiten, is irregular; but bereiten, *to make ready* (from bereit, *ready*) is regular, like all derivatives. (37) In the signification of *to procure*, *to get*, it is regular, as also anſchaffen, *to purchase*, *to buy*: abſchaffen, *to part with*, *to dismiss*.

TRANSLATION FROM GERMAN.

Der hungrige Araber.

Ein Araber war verirrt in der Wüſte. Zwei Tage hatte er nichts zu eſſen und war in Gefahr, Hungers zu ſterben, als er endlich eine von den Waſſergruben antraf, an denen die Reiſenden ihre Kameele tränkten. Hier ſah er auf dem Sande einen kleinen ledernen Sack liegen. „Gott ſei gelobt," ſagte er, als er ihn aufhob und anfühlte; „das ſind, glaube ich, Datteln oder Nüſſe; wie will ich mich an ihnen erquicken und

In dieſer ſüßen Hoffnung öffnete er den Sack, ſah was er enthielt und rief voll Traurigkeit aus, „Ach, es ſind nur Perlen."

KEY TO TRANSLATION FROM GERMAN (p. 303).

THE LITTLE CANARY BIRD.

A little girl named Caroline had a most lovely canary bird. The little creature sang from early morning till the evening;

and was very beautiful, golden yellow with (a) black tuft. Caroline gave him seeds and cooling herbs to eat; sometimes also a piece of sugar, and fresh water every day.

But suddenly the bird began to mope; and one morning when Caroline wished to bring him water, he lay dead in the cage. Then the little one raised a loud lamentation over the beloved creature, and wept bitterly. But the mother of the girl went out, and bought another one, which was still more beautiful in colour, and sang just as well as the other, and put it in the cage. But the maiden wept still louder when she saw the new bird. Then the mother wondered very much, and said: "Why do you cry still, and are so very sad? Your tears will not call the dead bird to life, and to-day you have another one, which is not worse than the first." Then the child said: "Alas, dear mother, I have done wrong towards the little creature, and not done everything to him which I should and could."

"Dear Lina," answered the mother, "you have indeed carefully nursed him." "Alas, no!" answered the child still; "I did not bring to him, shortly before his death, a little piece of sugar, which you gave me for the same, but ate (it) myself" So spoke the maiden, with a sad heart. But the mother did not smile over the complaint of the maiden; for she well recognised and honoured the holy voice of Nature in the heart of the child. "Alas!" said she, "how would the ungrateful child feel at the grave of its parents?"

ARCHITECTURE.—III

[*Continued from p.* 278.]

GREEK.

WE have in this lesson to describe the architecture of a people who, whilst borrowing many of their designs from Eastern sources, so transformed and perfected them that they not only virtually became their own, but constituted the parent stock from which other nations, in succeeding styles, derived their principal inspiration.

Owing to the paucity of earlier examples in Egyptian and Assyrian architecture, we were unable to trace the gradual growth of style from the earlier efforts to the perfected examples, and there does not appear to have been that constant development, that research for a higher quality of beauty of form and proportion, which we find in the Greek temples. The temples built by Rameses in the 13th century B.C. and those built under the Roman domination show but little change in their features and decoration through a period of fourteen to fifteen centuries.

Greek architecture, however, may be divided into three periods: its archaic state, its perfected condition, and its decadence.

The first period owes its development to the Pelasgic tribes, the earliest settlers in Greece, who were subsequently displaced by other migrations from the East: the Hellenic tribes who settled in Macedonia and Thrace, the Dorian tribes in the Peloponnesus, and the Ionic tribes in Asia Minor—all influenced, as is natural with maritime peoples, by constant communication with foreign nations; receiving indirectly through the Phœnicians (the great carriers of the ancient world) from Egypt, and through Asia Minor from Assyria, those artistic treasures for which the Eastern nations are proverbial, and which show us the origin of many of those decorative features which we subsequently recognise in Greek architecture.

The first period, the archaic, dates from the prehistoric times of the 12th century B.C. down to a little after the close of the Persian invasion—in about 450 B.C.

The second period (450 B.C.—324 B.C.) is the great temple-building period, during which time all the finest works of Greek art, including architecture, sculpture, and painting, were executed, not only in Greece herself but in her colonies in Sicily, Magna Græcia, in the islands of the Archipelago, and on the coast of Asia Minor.

Then follows a long lapse, during which no buildings of importance seem to have been erected; and it is not till Greece came under the domination of the Romans—whose emperors vied with one another in showing their tribute of admiration to Greek art by erecting temples and other buildings in the conquered provinces, though they despoiled her of her chief treasures to transport them to Rome—that Greek architecture again flourished, but in so weak and impoverished a condition (artistically speaking) that it can only be called a period of decadence.

The earlier works of the archaic period are more interesting from an archæological point of view than from an architectural one. They consist of the walls built to protect some of their chief citadels, walls which from their peculiar construction and from the size of the stones are attributed to a fabulous people, and called Cyclopean. Mr. Gladstone suggests a new term for them—viz., Poseidonic. They are, however, better known under the first appellation.

These walls are of three kinds: firstly, those in which blocks of stone of polygonal form and unwrought are piled one on the other, smaller stones being used to fill in the interstices; secondly, polygonal blocks of various sizes, all wrought and fitted together with narrow joints so as to form one mass of wall; and thirdly, quadrangular blocks of stone laid generally in horizontal courses, but with upright joints not always vertical.

The principal places at which these Cyclopean walls are found are Mycenæ, Tiryns, and Ilium. It is a class of construction, however, found not only in Greece but through Italy (Etruria), in which country they are attributed to the Etruscans, a race supposed to be akin to the Pelasgi of Greece.

The walls of the Acropolis of Mycenæ were 16 feet thick, and from 13 to 35 feet high. Here also is found the Gate of Lions, the great gate of the citadel, so called for its possessing, in a triangular slab above the lintel, the earliest specimen of Greek sculpture: this consists of two lions "rampant," in heraldic phraseology, on each side of a shaft or column—(there is a cast of this remarkable work in the South Kensington Museum). Close to the citadel of Mycenæ, but outside its walls, is the structure called erroneously the Treasury of Atreus, now recognised as a tomb. It is circular in plan, its internal diameter and height being 50 feet, and is built in the form of a beehive; the stones of which it is constructed projecting one over the other till they meet at the top. The stones are of much greater size at the bottom; it was entirely covered over with earth after its erection, becoming virtually therefore a subterranean tomb, to which access was obtained through a paved causeway. One of the stones forming the lintel was 29 feet long, 17 feet wide, and 3 feet 9 inches thick, weighing over 100 tons. There were other tombs of this class at Mycenæ, of which altogether, here and elsewhere, eleven examples are known. Some of these and the walls of palaces have been made known to us through the researches of the late Dr. Schliemann. One class of building, however, is absent—viz., the temple; and it is not till we come down to the seventh century (about 650) B.C. that we find the first example in the Doric temple of Corinth. The researches made at Hissarlik, the reputed town of Troy, have not been so successful, owing to the more or less complete destruction of the palace there; but of the palace at Tiryns sufficient remains to enable us to restore in our imagination at least some of the features of the palace of Ulysses as described in the "Odyssey."

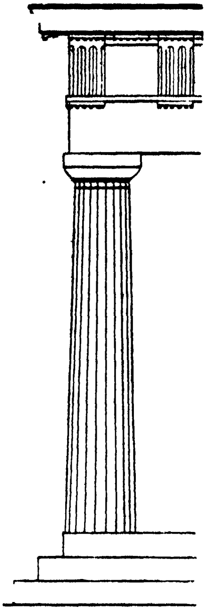

Fig. 7.—The Doric Order.

The earliest example of temples of the archaic period is that already mentioned at Corinth, of which a few columns only remain: they are of the Doric order, very stately in proportion, and still carry the architrave (*epistylium*), or beam, which supported the roof. After Corinth come some of the temples at Selinus in Sicily; and at the close of the sixth century B.C., the temple of Ægina, also of the Doric order.

It now becomes necessary to say a few words about the "orders," as they are called, and which are known as the Doric, Ionic, and Corinthian orders. The two first were developed independently one of the other by different races. An order consists of several parts, all constructive in their origin, but, as employed, partly constructive and partly decorative: its principal feature is the column (with or without a base), which is crowned by a capital, on which rests the entablature. The entablature is divided into three parts: the architrave, epistyle, or beam, which rests on the capital; the frieze, the depth of which corresponds to the minor beams resting behind on the architrave; and the cornice, which overhangs the frieze to protect it and the building beneath, and sometimes carries the gutter of the roof. We have no clue to the origin of the Doric (Fig. 7) order. It has been assumed by some that it was derived from Egypt; but the polygonal column there found has a base, which shows it was copied from a wooden column (a wooden column requires a base to prevent the decay of its lower part from damp); there is also no cushion under the abacus, or crowning member, of the Doric column. When we come to the Ionic (Fig. 8) order, we are on surer ground, for the base, the fluting of the shaft or column, and the volute capital, all betoken an Asiatic origin, such as we find in Persian architecture already described. The Ionic order was probably developed in Asia Minor, though it is difficult to find its earliest types.

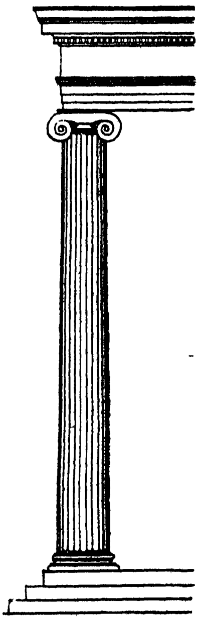

Fig. 8.—The Ionic Order.

The Corinthian order is of very much later date, and may fairly be supposed to have been suggested by the bell capital of Egypt already referred to. It has been thought by some that it has a metallic origin, and that its leaves and volutes were originally forged in metal and applied to the bell capital, subsequently being copied in stone.

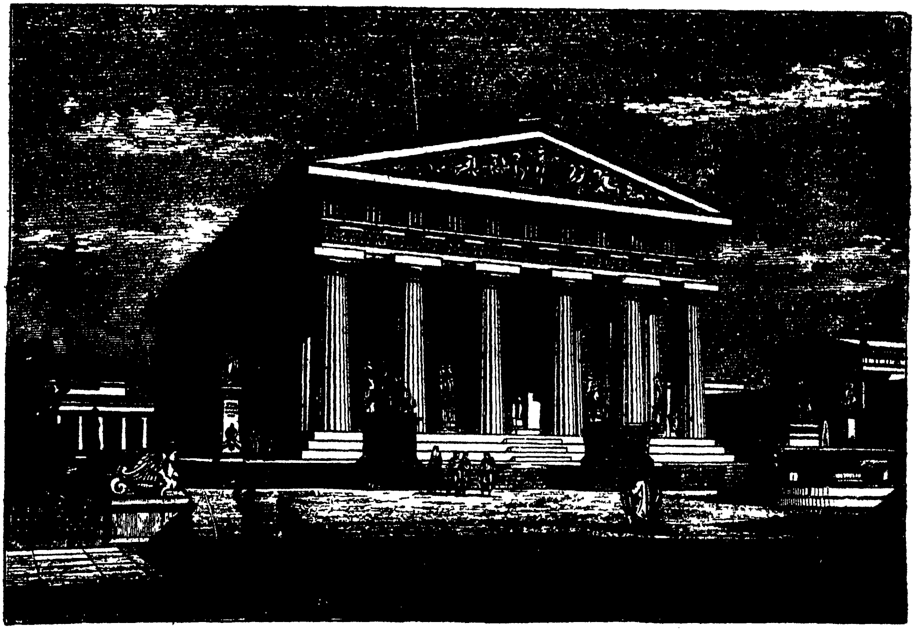

Fig. 9.—Temple of Poseidon at Pæstum. (*Restoration.*)

The nature of the forms and their application will be better understood by a description of the class of building which they were employed to decorate, and in which they formed also the essential constructive element.

It has already been pointed out—in the second lesson—that the Egyptian temple formed the model from which all other structures borrowed their leading features; and although, as we have already stated, no remains have been found of any early archaic temples, we may fairly assume that the sanctuary or temple of the Deity must, in these early times as in those of a later period, have called forth the higher instincts of man's imagination in its conception, and the greatest perfection of work they were capable of in its erection.

The development and growth of the Greek temple, like that of the Egyptian, was cumulative; that is to say, in course of time it became more and more important; but there the similarity ceases. The Egyptian temples were enclosed with lofty walls, and hidden by immense pylons. The Greek temple was isolated, and intended to be seen on all sides. With the exception of the addition of a *pronaos*, or vestibule, to the cell or sanctuary, and an *opisthodomus*, or treasury, behind it, we do not find that increase in the number of chambers and pillared halls as at Karnak and Edfou. Many of the Greek temples enclose only the simple sanctuary—that which we may regard as the germ of the primitive temple—consisting of four walls and covered with a sloping roof, the ends of which, or the front and back elevation, formed that feature known as a pediment.

To give the front more dignity in appearance, or possibly to yield shelter to the priest standing before the door (the priest only entered a Greek temple), or again to afford protection to the paintings or votive shields, by prolonging the side walls and providing two columns to carry the entablature or pediment, a porch would be formed which is constantly found in Greece, and is known as a portico-in-antis. The temple being visible on all sides, for the sake of symmetry a similar feature would be added at the back; it served no purpose except the protection of paintings or sculpture, there being no entrance door on that side. Suppressing the prolongation of the wall and substituting columns, we arrive at the type of temple—known as tetrastyle—with four columns in front: the word prostyle added would indicate a front portico only; if added to the back as well, the full title would be tetrastyle amphiprostyle. When six columns were placed in front, the term hexastyle was given; and the consequent increase in width (the sanctuary being always of modest dimensions) allowed of columns being carried down the flanks or sides, forming what is known as a peristyle; in such cases there being always a portico at each end as well. With eight columns in front the temple was octastyle.

When ten columns were employed in front, a greater splendour and richness was given by forming double rows all round, the temple thus becoming decastyle and dipteral. In some cases the inner row of columns was omitted, the peristyle being then of double width, and the term pseudo-dipteral was given to it. There is a temple at Agrigentum in Sicily, dedicated to Jupiter, which has seven columns in front (heptastyle), and one at Pæstum in Magna Græcia with nine; but these are exceptions.

As a rule, on the flanks of a temple there are twice as many columns as there are in the front, plus one. Thus in an octastyle temple with eight columns in front, there will be (counting the east ones again) seventeen on each flank. The rule is not invariable, but it exists in the best examples. The great prolongation of the temple would lead to too great a length for the cella. A pronaos or vestibule was therefore introduced in the front, and a *posticum* at the back. In large temples we find in addition an opisthodomus, or treasury, for the offerings made to the Deity.

In large temples the increased width given to the cella would render it too wide to be roofed over without intermediate supports (especially as the finest temples were covered with marble slabs in imitation of tiles); a row of columns therefore was carried on each side of the cella, and these were arranged in two storeys one above the other, with an architrave between, which may sometimes have supported a gallery. In the treasury, columns of the Ionic order, of much lighter proportions, were used so as to economise space.

In order to give the temple more importance, it was placed on a base or stylobate consisting of three steps; the height of the steps varying, according to the size of the temple, from 6 inches to 18 inches or more.

There is one exceptional building, the Erectheum, in which three temples—or, rather, two temples and a portico of caryatid figures—all placed on different levels, are combined together in one picturesque and harmonious assemblage.

This description of the various plans of Greek temples, which is not necessarily chronological, will enable our readers to understand better the application of the orders already enumerated.

The plans being of the simplest and most elementary character, the great artist was enabled to concentrate all his imagination and thought on the perfecting of the traditional forms handed down to him, and his knowledge of construction in their execution. The rivalry of the various states of Greece tended also greatly to the development of the architectural style of their temples. The blending of the two races—of the rude and hardy Dorian race with the softer nature of the Ionians—raised the Greek style to a position which it still holds above all other styles, in the beauty of its forms and delicacy of its ornament and mouldings, in its perfection of execution, and last, though not least, its being the framework in which the noblest efforts of man's genius, the sculptures of Phidias and his contemporaries, were incorporated.

We may now proceed to a description of the principal buildings of Greece, foremost amongst which comes the Parthenon in the Acropolis of Athens and dedicated to Minerva. Using the terms already described, the Parthenon is octastyle-peristylar. It is of the Doric order; the height of the columns being 30 feet, equal to 5½ times the lower diameter of the columns. (This method of establishing the relative proportions of the column is due to Vitruvius, a Roman author of the Augustan era, and was probably not that employed by the Greeks.) The columns of the temple of Corinth, already referred to as the earliest Doric temple known, have a height of four diameters only, thus showing that the development was towards greater lightness and elegance. The Doric columns of the Parthenon carried an entablature consisting of architrave, frieze, and cornice, equal to twice the diameter of the columns—11 feet. Above the cornice on the front and back elevations rose the pediment, the sloping sides of which represented the roof behind; and the whole building was raised on a stylobate, six feet high, of three steps.

The stylobate, the columns and their capitals, the entablature and pediments, and the wall, were all built of Pentelic marble; as also the covering of the peristyle. The roof was constructed in timber, and carried a covering, in imitation of tiles, made of Parian marble. The materials, therefore, and the construction were of the finest possible kind. So far the description is easy; but the refinements carried into the proportions and the completed surfaces are of the most delicate nature, introduced (so far as we are able now to follow) to correct certain optical delusions. The columns taper to a less diameter at the top than they are at the bottom; their sides, however, are not straight, but have a slight curve known as the entasis. The intercolumniation—viz., the space between the centre columns—is wider than the others (Vitruvius says, to allow the statue of the deity to be better seen); that between the two angle columns much closer, to give a greater appearance of strength, the intercolumniation of the others diminishing from the centre pair outwards. The central axis of the outer columns bends slightly inwards, to give also increased apparent stability and force; and lastly, the horizontal lines of the stylobate, entablature, and pediment cornice, are all minutely curved. The upper part of the stylobate, for instance, which is 100 feet long, rises two inches in the centre—an imperceptible difference, but of which the Greek artist must have recognised the necessity for so subtle a curve. In the metopes, in the spaces between the triglyphs in the frieze, were 92 groups of sculpture, 15 of which are in the British Museum, as also a portion of the Panathenaic frieze from the walls of the peristyle, and some of the figures from the two pediments. Of other Doric temples we have the temple of Theseus (now known as that of Hephaistos) at Athens, the temple of Jupiter in the island of Ægina, both hexastyle; and numerous examples at Selinus, Agrigentum, Segesta, and Syracuse in Sicily; of Pæstum (Fig. 9) in Magna Græcia (south of Italy); and elsewhere

Of Ionic temples, at Athens there are the Erectheum already referred to, the temple of Wingless Victory, the temple of Minerva at Priene, and of Apollo Didymæus near Miletus; the most celebrated of all being perhaps the temple of Diana at Ephesus, the remains of which were discovered a few years ago and are now in the British Museum.

Of the Corinthian order, only two Greek examples are known in fair preservation (many other capitals have been found)—viz., the Choragic monument of Lysicrates, and the porch of the Temple of the Winds, both at Athens.

Of other Greek buildings, there are the propylons or entrance gateways of the Acropolis, Athens, and at Eleusis; the far-famed tomb of Mausolus, at Halicarnassus, one of the seven wonders of the ancient world (the remains of which are now in the British Museum); the temples, treasuries, and other buildings at Olympia, the plans of which have lately been laid bare by German explorers; and the Greek theatres at Athens (Theatre of Bacchus), at Dramysus (the ancient Dodona), at Epidaurus, Syracuse, and elsewhere.

LATIN.—XXXVI.

[*Continued from p.* 321.]

THE AGRICOLA OF TACITUS (*continued*).

The Battle (*continued*)

37. Et Britanni, qui adhuc pugnae expertes summa collium insederant et paucitatem nostrorum vacui spernebant, degredi paulatim et circumire terga vincentium coeperant, ni id ipsum veritus Agricola quattuor equitum alas, ad subita belli retentas, venientibus opposuisset, quantoque ferocius adcucurrerant, tanto acrius pulsos in fugam disjecisset. Ita consilium Britannorum in ipsos versum, transvectaeque praecepto ducis a fronte pugnantium alae aversam hostium aciem invasere. Tum vero patentibus locis grande et atrox spectaculum: sequi, vulnerare, capere, atque eosdem oblatis aliis trucidare. Jam hostium, prout cuique ingenium erat, catervae armatorum paucioribus terga praestare, quidam inermes ultro ruere ac se morti offerre. Passim arma et corpora et laceri artus et cruenta humus; et aliquando etiam victis ira virtusque. Postquam silvis appropinquaverunt, item primos sequentium incautos collecti et locorum ignaros circumveniebant. Quod ni frequens ubique Agricola validas et expeditas cohortes indaginis modo, et sicubi artiora erant, partem equitum dimissis equis, simul rariores silvas equitem perscrutari jussisset, acceptum aliquod vulnus per nimiam fiduciam foret. Ceterum ubi compositos firmis ordinibus sequi rursus videre, in fugam versi, non agminibus, ut prius, nec alius alium respectantes, rari et vitabundi invicem longinqua atque avia petiere. Finis sequendi nox et satietas fuit. Caesa hostium ad decem milia: nostrorum trecenti sexaginta cecidere, in quis Aulus Atticus praefectus cohortis, juvenili ardore et ferocia equi hostibus inlatus.

The Results of the Battle.

38. Et nox quidem gaudio praedaque laeta victoribus: Britanni palantes mixtoque virorum mulierumque ploratu trahere vulneratos, vocare integros, deserere domos ac per iram ultro incendere, eligere latebras et statim relinquere; miscere in vicem consilia, dein separare; aliquando frangi aspectu pignorum suorum, saepius conciatri. Satisque constabat saevisse quosdam in conjuges ac liberos, tamquam misererentur. Proximus dies faciem victoriae latius aperuit: vastum ubique silentium, deserti colles, fumantia procul tecta, nemo exploratoribus obvius. Quibus in omnem partem dimissis, ubi incerta fugae vestigia neque usquam conglobari hostes compertum, et exacta jam aestate spargi bellum nequibat, in fines Borestorum exercitum deducit. Ibi acceptis obsidibus, praefecto classis circumvehi Britanniam praecipit. Datae ad id vires, et praecesserat terror. Ipse peditem atque equites lento itinere, quo novarum gentium animi ipsa transitus mora terrerentur, in hibernis locavit. Et simul classis secunda tempestate ac fama Trutulensem portum tenuit, unde proximo Britanniae litore lecto omni, redierat.

The Reception of the News at Rome.

39. Hunc rerum cursum, quamquam nulla verborum jactantia epistulis Agricolae auctum, ut Domitiano moris erat, fronte laetus, pectore anxius excepit. Inerat conscientia derisui fuisse nuper falsum e Germania triumphum, emptis per commercia, quorum habitus et crines in captivorum speciem formarentur: at nunc veram magnamque victoriam tot milibus hostium caesis ingenti fama celebrari. Id sibi maxime formidolosum, privati hominis nomen supra principis attolli: frustra studia fori et civilium artium decus in silentium acta, si militarem gloriam alius occuparet; cetera utcumque facilius dissimulari, ducis boni imperatoriam virtutem esse. Talibus curis exercitus, quodque saevae cogitationis indicium erat, secreto suo satiatus, optimum in praesentia statuit reponere odium, donec impetus famae et favor exercitus languesceret: nam etiam tum Agricola Britanniam obtinebat.

Agricola's Return.

40. Igitur triumphalia ornamenta et inlustris statuae honorem et quidquid pro triumpho datur multo verborum honore cumulata, decerni in senatu jubet addique insuper opinionem, Suriam provinciam Agricolae destinari, vacuam tum morte Atilii Rufi consularis et maioribus reservatam. Credidere plerique libertum ex secretioribus ministeriis missum ad Agricolam codicillos, quibus ei Suria dabatur, tulisse, cum praecepto ut, si in Britannia foret, traderentur; eumque libertum in ipso freto Oceani obvium Agricolae, ne appellato quidem eo ad Domitianum remeasse, sive verum istud, sive ex ingenio principis fictum ac compositum est. Tradiderat interim Agricola successori suo provinciam quietam tutamque. Ac ne notabilis celebritate et frequentia occurrentium introitus esset, vitato amicorum officio noctu in urbem, noctu in Palatium, ita ut praeceptum erat, venit; exceptusque brevi osculo et nullo sermone turbae servientium inmixtus est. Ceterum uti militare nomen, grave inter otiosos, aliis virtutibus temperaret, tranquillitatem atque otium penitus auxit, cultu modicus, sermone facilis, uno aut altero amicorum comitatus, adeo uti plerique, quibus magnos viros per ambitionem aestimare mos est, viso aspectoque Agricola quaererent famam, pauci interpretarentur.

41. Crebro per eos dies apud Domitianum absens accusatus, absens absolutus est. Causa periculi non crimen ullum aut querela laesi cuiusquam, sed infensus virtutibus princeps et gloria viri ac pessimum inimicorum genus, laudantes. Et ea insecuta sunt rei publicae tempora quae sileri Agricolam non sinerent: tot exercitus in Moesia Daciaque et Germania et Pannonia temeritate aut per ignaviam ducum amissi, tot militares viri cum tot cohortibus expugnati et capti; nec jam de limite imperii et ripa, sed de hibernis legionum et possessione dubitatum. Ita cum damna damnis continuarentur atque omnis annus funeribus et cladibus insigniretur, poscebatur ore vulgi dux Agricola, comparantibus cunctis vigorem et constantiam et expertum bellis animum cum inertia et formidine ceterorum. Quibus sermonibus satis constat Domitiani quoque aures verberatas, dum optimus quisque libertorum amore et fide, pessimi malignitate et livore pronum deterioribus principem exstimulabant. Sic Agricola simul suis virtutibus, simul vitiis aliorum in ipsam gloriam praeceps agebatur.

He Declines a Proconsulate.

42. Aderat jam annus, quo proconsulatum Africae et Asiae sortiretur, et occiso Civica nuper nec Agricolae consilium deerat nec Domitiano exemplum. Accessere quidam cogitationum principis periti, qui iturusne esset in provinciam ultro Agricolam interrogarent. Ac primo occultius quietem et otium laudare, mox operam suam in adprobanda excusatione offerre, postremo non jam obscuri suadentes simul terrentesque pertraxere ad Domitianum. Qui paratus simulatione, in adrogantiam compositus, et audiit preces excusantis et, cum adnuisset, agi sibi gratias passus est, nec erubuit beneficii invidia. Salarium tamen proconsulare solitum offerri et quibusdam a se ipso concessum Agricolae non dedit, sive offensus non petitum, sive ex conscientia, ne quod vetuerat videretur emisse. Proprium humani ingenii est odisse quem laeseris: Domitiani vero natura praeceps in iram, et quo obscurior eo inrevocabilior, moderatione tamen prudentiaque Agricolae leniebatur, quia non contumacia neque inani jactatione libertatis famam fatumque provocabat. Sciant, quibus moris est inlicita mirari, posse etiam sub malis principibus magnos viros esse, obsequiumque ac modestiam, si industria ac vigor adsint, eo laudis escendere, quo plerique per abrupta, sed in nullum rei publicae usum, ambitiosa morte inclaruerunt.

NOTES TO TACITUS (*continued*).

Chap. XXXVII.—*Vacui* means "free from care." Translate it by an adverb in English; "were calmly despising."

Terga. "The rear."

Ad subita belli retentas. "Reserved for the emergencies of war." The neuter accusative of an adjective followed by a genitive is a favourite idiom with Tacitus. In this chapter you have two instances, *summa collium* and *subita belli.*

Terga praestare. "Turned their back upon," *i.e.*, "fled before."

Collecti. "They rallied."

Indaginis. *Indago* is properly an "enclosing or surround-

ing of wild animals." Then it denotes a net or series of nets used to enclose a wood, and so is extended to all the operations of huntsmen.

Non agminibus. "Not in marching order."

Rari et vitabundi invicem. "Scattered and avoiding one another."

Chap. XXXVIII.—*Separare.* This does not mean "to separate" in the English sense. It is a transitive verb, and *consilia* must be construed with it. "In turn they took counsel together, then each thought for himself."

Pignorum. *Pignus* literally means a "pledge"; hence it denotes a near relation, such as a child or wife.

Proximus dies, etc. "The next day revealed more fully the result of the victory."

Quibus, i.e., exploratoribus, those sent out to reconnoitre.

Spargi bellum. This is an uncommon phrase, "the war could not be spread farther."

Boresti. Who the Boresti were is uncertain, perhaps the inhabitants of Fife.

Novarum gentium. "The newly-conquered tribes."

Ipsa transitus mora. "By the actual slowness of the march."

Lecto. Legere frequently, as in this passage, means "to coast."

Chap. XXXIX.—*Domitiano moris erat.* This construction is unusual. We should expect *Domitianus, ut illi moris erat.* But the nominative to *excepit* must be inferred from *Domitiano.*

Derisui. This is an example of the predicative dative.

Falsum triumphum The Emperor Domitian having failed in his campaign against Germany, and yet unwilling to be foiled of his triumph, purchased slaves and had their hair dyed and their costume arranged that they might look like Germans. So paltry a fraud as this naturally seemed all the more contemptible after Agricola's *vera magnaque victoria.*

Cetera dissimulari. "Other successes might be overlooked."

Ducis boni, etc. "The valour of a great general was a quality worthy of an Emperor."

Reponere odium. "To reserve his hatred."

Chap. XL.—*Ex secretioribus ministeriis.* "Employed on confidential missions."

Codicillos. This has a technical meaning. It denotes an ordinance or despatch of the Emperor himself.

Ex ingenio principis. "In accordance with the Emperor's character."

Brevi osculo. "A hasty embrace."

Grave inter otiosos. "Distasteful to civilians."

Per ambitionem. "By their ostentation."

Chap. XLI.—*Causa periculi.* The cause of Agricola's danger was threefold:—(1) the Emperor's hatred of merit; (2) his own good name; (3) the mischief of flatterers.

Dacidque. In 86 A.D. the Dacians rebelled and attacked the Roman legions while they were still in winter quarters.

Vigorem et constantiam. "Energy and firmness."

Ceterorum. This sentence comes to an abrupt termination. Some editors read *eorum* and put in the words, *quibus exercitus committi solerent,* "to whom the armies were usually entrusted." But this reading is purely conjectural.

Verberatus. A very strong expression. "The ears of Domitian were attacked," literally, "lashed."

In ipsam gloriam praeceps agebatur. "Was hurried headlong upon glory."

Chap. XLII.—*Civica occiso.* The death of Civica might at once suggest counsel to Agricola, a precedent to Domitian.

Ultro. "On their own account," *i.e.,* unprompted by the Emperor.

In adprobanda excusatione. "In making good an excuse."

Non jam obscuri, i.e., "throwing off all disguise." The object of the Emperor's creatures was to induce Tacitus to decline the province, which was rightfully his, and in this they succeeded.

Paratus simulatione. "Equipped with pretences."

Agi sibi gratias passus est. "Permitted himself to be thanked."

Ne quod vetuerat, etc. "Lest he should appear to have bought that which he had forbidden." Had Agricola accepted the salary, it might have seemed that the Emperor had bribed him not to accept a province, whereas in reality he had forbidden him to do so.

Quo obscurior eo inrevocabilior. "The more irrevocable, the more it was concealed."

Sciant. "Let those take notice."

Eo laudis. "To such a height of glory."

Quo plerique . . . . inclaruerunt. "Whither must men climb by steep paths, rendering meanwhile no service to the State, and become notorious by an effective death."

KEY TO TACITUS (*continued*).

31. "Nature has designed that a man's children and kindred should be dearest of all things to him. These are snatched from us by conscriptions, and doomed to bondage in other parts of the earth. Our wives and sisters, though they escape violation from our enemies, are debauched under the pretence of friendship and hospitality. Our possessions and fortunes they exhaust for tribute, our grain for their provisions. Even our bodies and limbs are wasted by clearing forests and draining bogs under continual blows and insults. Such as are born to be slaves are but once sold, and thenceforward fed by their lords. Britain is purchasing every day and every day is feeding her own slaves. Moreover as in a tribe of household slaves, he who comes last serves for sport to all his fellows; so in this ancient state of slavery to which the world is reduced, we, as late comers and worthless slaves, are now designed to destruction. For we have no fields to cultivate, nor mines to dig, nor ports to make; works for which we might be spared besides, magnanimity and a daring spirit in their subjects are ever distasteful to rulers, and solitude and remoteness, the more security they afford to us, do but raise the greater suspicion in them. Seeing therefore you are thus bereft of all hopes of mercy, now at last take courage, both you to whom life is dearest, and you to whom glory. The Brigantes, even under the leading of a woman, burned a colony, stormed an entrenchment, and, had not such success degenerated into sloth, might have quite cast off the yoke of slavery. Let us, fresh and unsubdued, about to fight for liberty, not for tolerance, manifest at once, upon the first encounter, what kind of men they are that Caledonia has reserved for herself.

32. "Do you indeed believe the Romans will be equally brave in war, as during peace they are dissolute? They are famous through our quarrels and discords, and thus they convert the faults of their enemies to the glory of their own army; an army compounded of many nations, so different that as it is success alone which holds them together, disasters will surely dissolve them · unless you suppose that the Germans and Gauls, and many of the Britons (whom with shame I mention)—who, though they give their blood in support of another's rule, have been enemies longer than slaves—are bound by good faith and

affection. Awe and terror are frail bonds of endearment; and when these are removed, such who cease to fear, will immediately begin to manifest their hate. Amongst us is found whatever can stimulate men to victory. The Romans have no wives to urge them. They have here no parents to upbraid them for flying. Many of them have no country at all, or at least their country is elsewhere. Few in number, frightened at their ignorance, beholding around them a sea and woods that are strange to them, the Gods have in some sort delivered them enclosed and bound into our hands. Be not dismayed with things of mere show, and with a glare of gold and of silver, which can neither wound, nor save. In the very host of the enemy we shall find our own troops. The Britons will espouse their own cause. The Gauls will recollect their former liberty. As the Usipians have lately left them, so the other Germans will abandon the Romans. Thereafter nothing remains to be feared. Their forts are ungarrisoned; their colonies held by aged men; and between the people averse from obedience, and their magistrates ruling with injustice, the cities are weakened and full of dissensions. Here you see a general and an army: there tribute and the mines, and the other penalties of men enslaved. Whether all these are to be for ever endured, or forthwith avenged, this very field must determine. As therefore you advance to battle, think of your ancestors and your posterity."

33. They received his speech joyfully, with chantings, and terrible din, and many dissonant shouts, after the manner of barbarians. Now the line formed, and there was seen the glitter of arms, as the boldest of the warriors advanced. As the army was forming in battle array, Agricola, though his soldiers were full of alacrity and hardly to be restrained within the fortifications, yet chose to discourse to them in the following strain:—"It is now the eighth year, my fellow-soldiers, since through the virtue and auspicious fortune of the Roman Empire, and by your own services and fidelity, you have been pursuing the conquest of Britain. In our many expeditions and battles, whether you had need of bravery against the foe, or patience and pains even against nature herself, neither have I had aught to regret in my soldiers, or you in your leaders. And so we have passed, I the limits known to former legates, you those known to former armies; and we possess the very extremity of Britain, not only in fame and rumour, but with our camps and arms. Britain has been discovered and subdued. In truth, often on the march whilst morasses and mountains and rivers have fatigued you, I was wont to hear every brave man ask, When shall we see the enemy, when will be the battle? Already they are come, roused from their fastnesses: your wishes and valour have an open field, and all things are propitious to the conqueror and disastrous to the vanquished. For to have thus marched over a tract of country so immense, to have passed through forests, to have crossed arms of the deep, is matter of glory and applause so long as we present a front to the foe; so if we fly before them, whatever is now most in our favour, will then prove most to our peril. We know not the situation of the country so well as they know it, we have not provisions so abundant as they have; but we have hands and arms, and in these, all things. For my own part, I have long made up my mind that retreat is safe neither for army nor leader. Therefore an honourable death is better than a base life, and security and renown both lie in the same direction. Neither would it be inglorious to fall in this verge of earth and of nature.

34. "Were strange tribes and an unknown enemy now arrayed against you, I should animate you by the examples of other armies. As things are, only recollect your great achievements, only consult your own eyes. These are they whom but the last year you utterly discomfited by a shout when, under cover of night, they attacked a single legion. These are they who of all the Britons are the most abandoned to flight, and thence happen thus long to survive. As when men penetrate woods and thickets, the beasts of the greatest strength rush upon them, while the timorous and spiritless fly even at the cry of the pursuers: in like manner all the bravest Britons are long since fallen; there is left a rabble of sloths and cowards; you have found them, not because they have resisted, but because they have been surprised; their desperate condition and the inaction which springs from extreme fear have fixed their army in yonder field, where you may gain over them a glorious and memorable victory. Have done with campaigns: close a struggle of fifty years with one great day: prove to your country that to the army may not be imputed either the procrastination of the war, or any cause for reviving it."

35. Apparent, even whilst Agricola spoke, was the ardour of the soldiers, mighty their enthusiasm at the end of his speech, and instantly they flew to their arms. Thus inflamed and urging to engage, he formed them so that the strong band of auxiliary foot, who were eight thousand men, composed the centre; while three thousand horse were added to the wings. The legions stood in front of the entrenchment; a great source of glory to his victory if the battle were fought without the loss of Roman blood; a sure stay should the rest be repulsed. The British line was raised upon the rising grounds, at once for show and terror, in such sort that the first band stood upon the plain, and the rest rose upon the slope of the hill in convex form; knights in chariots filled the plain between the two armies with great tumult and rapid movements. Agricola then, fearing from the surpassing multitude of the enemy that he might be beset at once in the front and on each flank, widened his ranks, and, though the line was likely to prove too extended, and many advised him to bring on the legions, he, who rather entertained a spirit of hope, and in all difficulties was ever firm, dismissed his horse and advanced on foot before the colours.

36. In the first onset the conflict was maintained at a distance. The Britons, with equal bravery and skill, armed with their huge swords and small bucklers, eluded or parried our missiles, whilst of their own they poured a torrent upon us, till Agricola encouraged three Batavian cohorts and two of the Tungrians to close with the enemy and bring them to an engagement hand to hand. This method of attack had long been practised by those veteran soldiers, but embarrassing to the enemy, as they were armed with very little targets and with swords of enormous size. For the swords of the Britons, which are blunt at the end, are unfit for grappling, and cannot support a close encounter. As the Batavians closed with the enemy, wounded them with the iron bosses of their bucklers, dug them in the face, and, bearing down all who withstood them upon the plain, were already carrying the attack up to the hills, the rest of the cohorts, incited by emulation and sudden ardour, joined with them and cut down all that were nearest to them. In the hurry of the victory many were left behind half dead or even unwounded. In the meantime their troops of cavalry took to flight; the chariots of war mingled with the battalions of foot; and though they had so lately struck terror, were now themselves beset with our close array, as also with the unevenness of the ground. Of a combat of cavalry this bore not the least appearance; since here, pressing obstinately up the hill, they were carried on with the bodies of their horses. Moreover, the war chariots, now abandoned and straggling, as also the affrighted horses destitute of drivers, ran hither and thither as fright drove them, sideways or in direct collision.

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